

PROFINET Cabling and Interconnection Technology

Guideline for PROFINET

Draft in PI Review

Draft 6.0 – Date October 2026
Order No.: 2.252

File name: PN-Cabling-Guide_2252_d60_Oct26

This draft is published for testing and review only. It must not be used for development purposes.

The review will be conducted as a PDF review. Please enter your change requests as comments in this PDF by January 26, 2027!

Prepared by PI Working Group 1 "Passive Network Components" in Committee B "Technologies".

NOTICE:

The information contained in this document is subject to change without notice. The material in this document details a PNO specification in accordance with the license and notices set forth on this page. This document does not represent a commitment to implement any portion of a PNO specification in any company's products.

The attention of adopters is directed to the possibility that compliance with or adoption of PNO specifications may require use of an invention covered by patent rights. PNO shall not be responsible for identifying patents for which a license may be required by any PNO specification, or for conducting legal inquiries into the legal validity or scope of those patents that are brought to its attention. PNO specifications are prospective and advisory only. Prospective users are responsible for protecting themselves against liability for infringement of patents.

WHILE THE INFORMATION IN THIS DOCUMENT IS BELIEVED TO BE ACCURATE, PNO MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS DOCUMENT INCLUDING, BUT NOT LIMITED TO ANY WARRANTY OF TITLE OR OWNERSHIP, IMPLIED WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR USE.

In no event shall PNO be liable for errors contained herein or for indirect, incidental, special, consequential, reliance or cover damages, including loss of profits, revenue, data or use, incurred by any user or any third party. Compliance with PNO specifications does not absolve manufacturers, from the requirements of safety and regulatory agencies (TÜV, BIA, UL, CSA, etc.).

USE OF TRADEMARKS:

PNO is the owner of several registered trademarks, such as PROFIBUS®, PROFINET®, omlox®, IO-Link®, MTP® and others. More detailed terms for the use can be found on the web page www.profibus.com. Please select buttons "Downloads / Presentations & logos". In some cases, PNO is the licensee of registered trademarks owned by third parties and which may be relevant in regard with products compliant to this document.

1 PNO shall always be the sole entity that may authorize developers, suppliers and sellers of hardware and software to use certification marks, trademarks or other special designations to indicate compliance with a PNO specification. Products developed using a PNO specification may claim compliance or conformance with a PNO specification only if the hardware and/or software satisfactorily meets the certification requirements set by PNO. Products that do not meet these requirements may claim only that the product was based on a PNO specification and must not claim compliance or conformance with a PNO specification.

COPYRIGHT

Copyright © 2002-2026 PROFIBUS Nutzerorganisation e.V.

Any unauthorized use of this publication may violate Copyright Law, Trademark Law and other legal regulations. This document contains information which is protected by Copyright. No part of this work covered by Copyright herein may be reproduced or used in any form or by any means -graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems--without permission of the publisher.

Publisher:
PROFIBUS Nutzerorganisation e.V.
Ohiostrasse 8
76149 Karlsruhe
Germany
Phone: +49 (0) 721 / 986 197 0
Fax: +49 (0) 721 / 986 197 11
E-Mail: info@profibus.com
Website: www.profibus.com

LICENSE AGREEMENT

1. License

1.1 Subject of this license agreement is this document issued by the Licensor, in electronic form. If applicable, also software may be provided.

1.2 The user of this document (Licensee) acquires the license solely from PROFIBUS Nutzerorganisation e.V., having its principal place of business in Karlsruhe, Germany (hereinafter referred to as "Licensor").

1.3 This document is not an industrial standard acknowledged by any standardization body or otherwise and may be further enhanced.

2. Rights and Duties of Licensee

2.1 Licensor hereby grants to Licensee the right to use this document exclusively for developing and supporting products compliant with this document. Licensee may copy this document for this purpose and for data backup purposes.

2.2 Licensee shall not be entitled to modify, decompile, reverse engineer or extract any individual parts of this document, unless this is permitted by mandatory Copyright Law. Furthermore, Licensee shall not be entitled to remove any alphanumeric identifiers, trademarks or copyright notices from this document and, insofar as Licensee is entitled to make copies of this document, Licensee shall copy them without alteration.

2.3 Licensee is not entitled to copy or redistribute this document to any third party, including any affiliated company of Licensee, except, in each case, to the extent necessary for "Have Made" purposes. For the avoidance of doubt, and except for copies redistributed for "Have Made" purposes as permitted above, any copy of this document must be obtained on an individual basis, directly from the website www.profibus.com or upon request from the Licensor.

2.4. Licensee agrees to comply with all applicable export control, trade, and sanctions regulations as well as embargo regulations of the European Union, the United States of America, and other relevant jurisdictions ("Export Control Regulations"). This applies in particular to the applicable Export Control Regulations relating to Russia and Belarus and with natural or legal persons associated with Russia and Belarus. Should Licensor become aware of any violation of Export Control Regulations with respect to the use of this document, PNO reserves the right to terminate this Agreement without notice and claim damages.

3. Liability of Licensor

3.1 Licensor shall have no obligation to enhance the document and shall assume no liability in case the document or future versions thereof shall not be approved as an industrial standard.

3.2 Licensor's liability for defects as to quality or title of this document, especially in relation to the correctness or absence of defects or the absence of claims or third-party rights or in relation to completeness, usability and/or fitness for purpose are excluded, except for cases involving gross negligence, willful misconduct or fraudulent concealment of a defect.

3.3 Any further liability is excluded unless required by law, e.g. in cases of personal injury or death, willful misconduct, gross negligence, or in case of breach of fundamental contractual obligations. The damages in case of breach of fundamental contractual obligations are limited to the contract-typical, foreseeable damage if there is no willful misconduct or gross negligence.

4. Place of Jurisdiction and Applicable Law

4.1 The sole place of jurisdiction shall be the principal place of business of Licensor.

4.2 All relations arising out of the contract shall be governed by the substantive law of Germany, to the exclusion of the United Nations Convention on Contracts for the International Sale of Goods (CISG).

In this specification the following key words (in **bold** text) will be used:

may: indicates flexibility of choice with no implied preference.

should: indicates flexibility of choice with a strongly preferred implementation.

shall: indicates a mandatory requirement. Designers **shall** implement such mandatory requirements to ensure interoperability and to claim conformance with this specification.

Content

A: General PROFINET Requirements and Specifications	11
1 Introduction	11
1.1 Management Summary – Purpose and Scope of the Document.....	11
1.2 List of Affected Patents	12
1.3 Related Documents and References.....	12
1.4 Definitions and Abbreviations	18
1.4.1 Terms and definitions.....	18
2 Component Classification and Certification	18
2.1 Supported Physical Layers	18
2.2 Component Classification: Cables & GPC Connectors	19
2.2.1 Lifecycle management.....	20
2.3 Environment Classification.....	23
2.4 PROFINET Cabling Systems	25
2.4.1 Adaptation to Cabling Systems	25
2.4.2 End-to-End (E2E) link assemblies and Component Approach for 2 and 4 pair cabling	25
2.4.3 PROFINET Cord Sets	27
2.4.4 PROFINET Cabinet cord sets	27
3 Guide to use	28
3.1 Cabling Systems for Application Areas	28
3.2 Application Areas	29
3.2.1 Inside Enclosure	29
3.2.2 Outside Enclosure	29
3.3 Assignment of Cabling Systems to Application Areas	30
B: PROFINET Cabling Systems	32
4 Cabling System 1-pair	32
4.1 Scope	32
4.1.1 System landscape	32
4.1.2 Physical layer References.....	33
4.2 Connectors	33
4.2.1 Connector Type IP20 DATA Connector Type I.....	33
4.2.2 PROFINET interconnection Module IP20 DATA Connector Type I	35
4.2.3 Connector Type IP6X M12 for DATA Connector	37
4.2.4 Connector Type IP6X M8 for DATA Connector.....	39
4.3 Cables	41
4.3.1 Balanced 1 pair Cables (Type A, B, C).....	41
4.4 Cord Sets	43
4.4.1 Standard Cord Sets (1pair).....	43
4.4.2 Cabinet Cord Set (1pair).....	43
4.4.3 Configuration.....	43
5 Cabling System 1-pair hybrid	46
5.1 Scope	46
5.1.1 System landscape	46
5.1.2 Physical layer References.....	47
5.2 Connectors and cables	47
5.2.1 M8 Hybrid SPE connectors according to IEC 63171-6 T1 Industrial Style	47

5.2.2	Cables	50
5.2.3	Cable Specification.....	51
5.2.4	Connector Type M12-SPE hybrid Type I	51
5.2.5	Feasible Cables	52
5.2.6	Connector Type M12-SPE hybrid Type II	55
5.2.7	Feasible Cables	56
5.2.8	1 pair hybrid cable specification	58
5.2.9	Connector Type M12-SPE hybrid Type VI.....	59
5.2.10	Assigned Cables M12-SPE hybrid Type VI	60
5.2.11	1 pair hybrid cable specification Type C	62
5.2.12	Connector Type M17 Type 1B coded	63
5.2.13	Assigned Cables M17-SPE hybrid Type 1B	64
5.2.14	Connector Type M23 Type 1 coded.....	66
5.2.15	Assigned Cables M23 Type 1	67
5.2.16	Connector Type M40 Type 1 coded.....	69
5.2.17	Assigned Cables M40 Type 1	70
5.3	Cord Sets Hybrid	72
5.3.1	Standard Cord Set Hybrid	72
6	Cabling System 2-pair	72
6.1	Scope	72
6.1.1	System landscape	73
6.1.2	Description of typical applications	73
6.1.3	Physical layer References.....	73
6.2	Connectors	73
6.2.1	General requirements	73
6.2.2	RJ45 2-pair Connector according to IEC 60603-7-3	74
6.2.3	Connector Type IP6X RJ45 2-pair Push Pull Connector for Balanced Cable	75
6.2.4	Connector Type IP6X M12-D 2-Pair Connector according to IEC 61076-2-101 D code	77
6.2.5	Connector Type IP6X Connector according to IEC 61076-2-114 M8-D coded	78
6.2.6	Miniaturized 2-pair Connector according to IEC 61076-3-122 (Mini IO).....	79
6.1	Cables	81
6.1.1	Balanced 2 pair Cables (Type A, B, C).....	81
6.2	Cord Sets	85
6.2.1	Standard Cord Set	85
6.2.2	Cabinet cord sets	86
6.2.3	Configuration	86
7	Cabling System 2-pair hybrid	88
7.1	Scope	88
7.1.1	System landscape	88
7.1.2	Physical layer References.....	89
7.2	Connectors and cables	89
7.2.1	Connector Type M12-Y coded Specification	89
7.2.2	Technical Requirements Connector	90
7.2.3	Assigned cables M12-Y Type 4	91
7.2.4	Hybrid cabling Type C	93
7.2.5	Connector Type M17 Type 2 B coded	94
7.2.6	Assigned Cables M17 Type 2 B.....	96

7.2.7	Connector Type M23 Type 2 coded.....	98
7.2.8	Assigned Cables M23 Type 2	99
7.2.9	Connector Type M40 Type 2 coded.....	101
7.2.10	Assigned Cables M40 Type 2	102
7.3	Cord Sets Hybrid	104
7.3.1	Standard Cord Set Hybrid	104
8	Cabling System 4-pair	104
8.1	Scope	104
8.1.1	System landscape	105
8.1.2	Description of typical applications.....	105
8.1.3	Physical layer References.....	105
8.2	Connectors	105
8.2.1	IP 6x 4 Pair Connector for Balanced Cable	105
8.2.2	RJ45 4-pair connectors according to IEC 60603-7 series	106
8.2.3	RJ45 4-pair Push Pull Connector for Balanced Cable	107
8.2.4	RJ45 4-pair connectors according to IEC 60603-7-1	108
8.2.5	M12-X-coded 4-pair Connector according to IEC 61076-2-109 M12-X coded	110
8.2.6	Miniaturized 4-pair Connector according to IEC 61076-3-122 (Mini IO).....	111
8.2.7	Miniaturized 4-pair Connector according to IEC 61076-3-124 (iX industrial).....	113
8.3	Cables	114
8.3.1	Balanced 4 pair Cables (Type A, B, C).....	114
8.4	Cord Sets	116
8.4.1	Standard Cord Set	116
8.4.2	Cabinet cord sets	116
8.4.3	Configuration.....	116
8.4.4	PROFINET Cabinet cord set specification.....	118
9	Cabling System FO.....	119
9.1	Scope	119
9.1.1	System landscape	119
9.1.2	Description of typical applications.....	120
9.2	Connectors	121
9.2.1	General requirements.....	121
9.2.2	Connector Type SC-RJ	121
9.2.3	Connector Type LC.....	123
9.3	Cables	125
9.3.1	General requirements.....	125
9.3.2	All-silica single mode optical fibre cables	126
9.3.3	All-silica multimode optical fibre cables	128
9.4	Cord Sets	130
9.4.1	Standard Cord Set	130
10	Cabling System Power	131
10.1	Scope	131
10.1.1	System landscape	131
10.1.2	Description of typical applications.....	131
10.1.3	Physical layer References.....	131
10.2	Connectors	132
10.2.1	General requirements.....	132

10.2.2 Connector Type M12 Power L-coded	133
10.3 Assigned Cables for power	135
10.4 Cord Sets	136
10.4.1 Standard Cord Set	136

Figures

Figure 1: Copper based communication for PROFINET	18
Figure 2: Procedure for Lifecycle management and new components	22
Figure 3: The different PROFINET cabling systems	25
Figure 4: E2E link without interconnections	26
Figure 5: E2E link with interconnections	26
Figure 6: Definition of the reference plain	26
Figure 7: Number of Interconnections in an PROFINET E2E-Link	27
Figure 8: Cabling Landscape with allocation of application areas	28
Figure 9: The PROFINET cabling system 1-pair	32
Figure 10: Cable example 1-pair	43
Figure 11: The PROFINET cabling system 1-pair hybrid	46
Figure 12: Cable example cross section 1-pair hybrid	50
Figure 13: Cable example cross section 1-pair hybrid	54
Figure 14: Cable example cross section 1-pair hybrid	58
Figure 15: Cable example cross section 1-pair hybrid	72
Figure 16: The PROFINET cabling system 2-pair	73
Figure 17: Design Integration Requirements	76
Figure 18: Cable example cross section 2-pair	85
Figure 19: The PROFINET cabling system 2-pair hybrid	88
Figure 20: Cable example cross section 2-pair hybrid	92
Figure 21: Cable example cross section 2-pair hybrid	104
Figure 22: The PROFINET cabling system 4-pair	105
Figure 23: Cable example cross section 4-pair	116
Figure 24: The PROFINET cabling system FO	120
Figure 25: The PROFINET cabling system power	131
Figure 26: Example of Push Pull Power to M12 power L coded	134

Tables

Table 1: PROFINET supported physical Layers	19
Table 2: List of PROFINET Connectors with Component Classification	20
Table 3: Environments Inside Enclosure and Outside Enclosure	24
Table 4: Supported Application Areas	28
Table 5: Assignment of application areas to cabling ecosystems	31
Table 6: IP20 DATA Connector Type I	33
Table 7: IP20 DATA Connector Type I	35
Table 8: IP6X M12 for DATA Connector	37

Table 9: IP6X M8 for DATA Connector	39
Table 10: Balanced 1 pair Cable Specification table part 1	41
Table 11: Balanced 1 pair Cable Specification table part 2	42
Table 12: Parameters of cord sets for balanced cabling	43
Table 13: PROFINET Cabinet cord set for 1 pair	45
Table 14: SPE connectors according to IEC 63171-6 T1 Industrial Style – Type M8 Hybrid	47
Table 15: Standard requirements of connectors according to IEC 63171-6	48
Table 16: Cable M8 hybrid SPE	49
Table 17: M12-SPE hybrid Type I	51
Table 18: M12-SPE hybrid Type I	52
Table 19: 1 pair hybrid cable specification Type C	54
Table 20: M12-SPE hybrid Type II	55
Table 21: M12-SPE hybrid Type II	56
Table 22: 1 pair hybrid cable specification Type C	58
Table 23: M12-SPE hybrid Type VI	59
Table 24: Assigned Cables M12-SPE hybrid Type VI	60
Table 25: 1 pair hybrid cable specification Type C	62
Table 26: M17 Type 1B coded	63
Table 27: Assigned Cables M17-SPE hybrid Type 1B	64
Table 28: M23 Type 1 coded	66
Table 29: Assigned Cables M23 Type 1	67
Table 30: M40 Type 1 coded	69
Table 31: Assigned Cables M40 Type 1	70
Table 32: Parameters of standard cord set Hybrid	72
Table 33: RJ45 2 pair Connector according to IEC 60603-7-3	74
Table 34: P6X RJ45 2-pair Push Pull Connector for Balanced Cable	75
Table 35: IP6X M12-D 2-Pair Connector according to IEC 61076-2-101 D code	77
Table 36: IP6X Connector according to IEC 61076-2-114 M8-D coded	78
Table 37: Miniaturized 2-pair Connector according to IEC 61076-3-122 (Mini IO)	80
Table 38: Balanced 2 pair Cable Specification Table part 1	82
Table 39: Balanced 2 pair Cable Specification Table part 2	83
Table 40: Balanced 2 pair Cable Specification Table part 3	84
Table 41: Parameters of cord sets for balanced cabling	85
Table 42: Requirements of PROFINET cabinet cord sets 2-Pair	87
Table 43: PROFINET Cabinet cord set specification	89
Table 44: Connector Type M12-Y Type 4 coded Specification	90
Table 45: Assigned cables M12-Y Type 4	91
Table 46: Hybrid cabling Type C	93
Table 47: M17 Type 2 B coded	94
Table 48: Assigned Cables M17 Type 2 B	96
Table 49: M23 Type 2 coded	98
Table 50: Assigned Cables M23 Type 2	99
Table 51: M40 Type 2 coded	101

Table 52: Assigned Cables M40 Type 2	102
Table 53: Parameters of standard cord set Hybrid.....	104
Table 54: RJ45 4 pair connectors according to IEC 60603 7	106
Table 55: RJ45 4-pair Push Pull Connector for Balanced Cable.....	108
Table 56: J45 4 pair connectors according to IEC 60603 7-1	109
Table 57: M12-X-coded 4-pair Connector according to IEC 61076-2-109 M12-X coded ..	110
Table 58: Miniaturized 4-pair Connector according to IEC 61076-3-122 (Mini IO).....	111
Table 59: Miniaturized 4-pair Connector according to IEC 61076-3-124 (iX industrial) ..	113
Table 60: Balanced 4 pair Cable Specification Table part 1	114
Table 61: Balanced 4 pair Cable Specification Table part 2	115
Table 62: Parameters of cord sets for balanced cabling	116
Table 63: PROFINET Cabinet cord set specification Table part 1.....	118
Table 64: Connector according to IEC 61754-24	122
Table 65: Standard requirements of connector	122
Table 66: Key characteristics of connectors	123
Table 67: Connector according to IEC 61754-20	124
Table 68: Standard requirements of connectors	124
Table 69: Key characteristics of connectors	125
Table 70: General Requirement	126
Table 71: Transmission Requirement	127
Table 72: Ambient Condition Requirement.....	127
Table 73: Mechanical Requirement	128
Table 74: General Requirement	128
Table 75: Transmission Requirement	129
Table 76: Ambient Condition Requirement.....	130
Table 77: Mechanical Requirement	130
Table 78: Key Characteristics Push-Pull, Power 5-way M12 power IEC 61076-3-126	132
Table 79: Standard requirements of connectors according to IEC 61076-3-126	132
Table 80: Connector according to IEC 61076-3-126 –Push Pull Power 5 way	133
Table 81: M12 Power L-coded	133
Table 82: Standard requirements M12 power L coded connector according to IEC 61076-02-111	133
Table 83: Pin assignment M12 power L coded 4 way according to IEC 61076-2-111.....	134
Table 84: Pin assignment M12 power L coded 5 way according to IEC 61076-2-111.....	134
Table 85: Pin assignment M12 power L coded 5 way according to IEC 61076-2-111.....	134
Table 86: Assigned Cables for power	135
Table 87: Parameters of standard cord set Hybrid.....	136

Revision Log

Version		Date	Changes/History
1.8	TC2WG6	12-Dec-2002	First draft in PI review
1.96	TC2WG6	31-Aug-2006	Second draft; structure changed, new content
1.99	TC2WG6	05-Oct-2006	WG
2.00	TC2WG6	12-Mar-2007	PI Review finished / Change Requests included
2.01	TC2WG6	03-Mar-2011	First WG Draft (2 and 4 pair Cabling)
2.02	TC2WG6	14-Apr-11	WG
2.03	TC2WG6	14-Apr-11	WG Draft
2.04	TC2WG6	27-Apr-11	Type A,B cable (outer diameter: 9 mm)
2.05	TC2WG6		Editorial revision
2.06	TC2WG6	23-Mai-11	Version for WG meeting 2011-05-26
2.1	TC2WG6	26-Mai-11	WG Draft
2.9	TC2WG6	14-Jun-11	PI Review
3.00	TC2WG6		PI Review finished / Change Requests included
3.01	CB/PG1	15-Nov-11	Final for publishing
3.02	CB/PG1	20-Nov-13	Cabinet cord set specification; M 12 x-coded contact arrangement
3.1	CB/PG1	06-Mar-14	Push Pull Signal, LC Fibre Optic
4.00	CB/PG1	02-Feb-17	M12 L-coded +cable, M8 D-coded, Push Pull LC
4.10	CB/PG1	May 2018	Colour Coding of M12 L and PushPull R cable for robotics applications added
5.0	CB/PG1	November 2020	Completely reworked, new content
5.2	CB/PG 1	November 2022	Additions for One Cable and SPE
5.3	CB/PG 1	May 2023	Final for release
5.4	CB/PG1	2025/2026	WG Draft
6.0	CB/PG1	October 2026	completely restructured

A: General PROFINET Requirements and Specifications

1 Introduction

1.1 Management Summary – Purpose and Scope of the Document

This document:

- describes the PROFINET cabling system and the connectors for PROFINET devices
- complements the fundamental provisions for the passive infrastructure of PROFINET networks inside and between the automation islands as specified in IEC 61918 and IEC 61784-5-3.
- is mandatory for manufacturers of PROFINET devices, cables and connectors, system integrators, manufacturers of test equipment for PROFINET cabling and test labs.

Guideline "Cabling and Interconnection Technology PROFINET" is aimed at device manufacturers and manufacturers of passive cabling and connectivity components. The installation of these passive components to build a PROFINET infrastructure is described in the PROFINET Installation Guidelines.

The provisions in this document provide the basis for a PROFINET conformity assessment and certification. Products matching the requirements defined in this PROFINET guideline may be declared as PROFINET-conform, following the procedures as outlined in this document.

In detail, this document specifies the following components:

- Connectors, cables, cord sets and other passive network components (e.g., bulkheads and connection terminals) for PROFINET communication (via optical fibre or balanced cabling)
- Connectors, cables and other passive network components for the PROFINET 24 V power supply

The passive components specified in chapter 1.4.1 of this document are categorized into the following three groups:

1. PROFINET General Passive Components (GPC)
2. PROFINET Specific Passive Components (SPC)
3. PROFINET Legacy Passive Components (LPC)

Furthermore, this document provides the requirements of the integration of PROFINET connectors into devices.

For the purposes of this guideline, PROFINET components are selected components for device integration and cabling that shall be used in the context of a PROFINET network.

A main aspect is to specify suitable components for all relevant application environments.

The components shall be seen as a coordinated and interoperability system that ensures particularly easy planning and installation.

The use of these cables and connectors represents a matched system that ensures a high interoperability.

1.2 List of Affected Patents

Attention is drawn to the possibility that some of the elements of this guideline may be the subject of patent rights as listed below.

The PROFIBUS Nutzerorganisation e. V. (PNO) shall not be held responsible for identifying any or all such patent rights.

Relevant patents are only those which have an impact on mating compatibility.

Affected Patents:

This guideline applies to internationally standardized interfaces. All patents are listed in the standard patent declaration.

In this guideline only interfaces are taken into account, which have no patents or whose patents can either be used freely or for which are granted under normal market conditions (see related international standards).

Patents that exist within the standard that must be taken into account in accordance with the applicable regulations of standardization are not listed here.

The passive components based on the interfaces can in turn be protected by patent.

PROFIBUS & PROFINET International (PI) does not guarantee the completeness of the affected patents.

1.3 Related Documents and References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 11801-series: Information technology – Generic cabling for customer premises

ISO/IEC 14763-4 Information technology - Implementation and operation of customer premises cabling - Part 4: Measurement of end-to-end (E2E)-Links

ISO 23570-3: Industrial automation systems and integration — Distributed installation in industrial applications — Part 3: Power distribution bus

EN 50289-1-6: Communication cables - Specifications for test methods - Part 1-6: Electrical test methods Electromagnetic performance

EN 50289-3-10: Communication cables - Specifications for tests methods - Part 3-10: Mechanical test methods - Torsion and twisting

EN 50289-3-16 Part 3-16: Mechanical test methods - Cable tensile performance

EN 50396: Nonelectrical test methods for low voltage energy cables

IEC 60050-series: International Electrotechnical Vocabulary

IEC 60060–1: High-voltage test techniques. Part 1: General definitions and test requirements

IEC 60189-1: Low-frequency cables and wires with PVC insulation and PVC sheath. Part 1: General test and measuring methods

89	IEC 60227-2: Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V
90	Part 2: Test methods
91	IEC 60228: Conductors of insulated cables
92	IEC 60332-1-series: Tests on electrical and optical fibre cables under fire conditions
93	IEC 60332-3-24: Tests on electric and optical fibre cables under fire conditions - Part 3-24: Test
94	for vertical flame spread of vertically mounted bunched wires or cables - Category C
95	IEC 60512-6-3-series: Connectors for electronic equipment - Tests and measurements - Part 6-3:
96	Dynamic stress tests - Test 6c: Shock
97	IEC 60512-6-4: Connectors for electronic equipment - Tests and measurements - Part 6-4:
98	Dynamic stress tests - Test 6d: Vibration: sinusoidal
99	IEC 60529: Degrees of protection provided by enclosures (IP Code)
100	IEC 60603-7: Connectors for electronic equipment - Part 7: Detail specification for 8-way,
101	unshielded, free and fixed connectors
102	IEC 60603-7-3: Connectors for electronic equipment - Part 7-3: Detail specification for 8-way,
103	shielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz
104	IEC 60603-7-5: Connectors for electronic equipment - Part 7-5: Detail specification for 8-way,
105	shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz
106	IEC 60664-1: Insulation coordination for equipment within low-voltage supply systems - Part 1:
107	Principles, requirements and tests
108	IEC 60793-1-20: Optical fibres - Part 1-20: Measurement methods and test procedures - Fibre
109	geometry
110	IEC 60793-1-40: Optical fibres - Part 1-40: Attenuation measurement methods
111	IEC 60793-1-41: Optical fibres - Part 1-41: Measurement methods and test procedures - Bandwidth
112	IEC 60793-1-44: Optical fibres - Part 1-44: Measurement methods and test procedures - Cut-off
113	wavelength
114	IEC 60793-2-series: Optical fibres - Part 2, specification of A1-OM2,3,4,5 and A1-OM1 multimode
115	fibre
116	IEC 60794-1-series: Optical fibre cables – Generic specification – General
117	IEC 60794-1-2: Optical fibre cables - Part 1-2: Generic specification - Basic optical cable test
118	procedures - General guidance
119	IEC 60811-203 Part 203: General tests - Measurement of overall dimension
120	IEC 60811-401: Electric and optical fibre cables - Test methods for non-metallic materials - Part
121	401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven
122	IEC 60811-501 Part 501: Mechanical tests - Tests for determining the mechanical properties of
123	insulating and sheathing compounds
124	IEC 60811-508: Electric and optical fibre cables - Test methods for non-metallic materials - Part
125	508: Mechanical tests - Pressure test at high temperature for insulation and sheaths
126	IEC 60811-509 Part 509: Mechanical tests - Test for resistance of insulations and sheaths to
127	cracking (heat shock test)
128	IEC 60874-14-series: Connectors for optical fibres and cables – all parts 14-x: Detail specification
129	for fibre optic connector type SC

- 130 IEC 60999-1: Connecting devices – Electrical copper conductors – Safety requirements for screw-
131 type and screwless-type clamping units – Part 1: General requirements and particular
132 requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)
- 133 IEC 61034-2: Measurement of smoke density of cables burning under defined conditions - Part 2:
134 Test procedure and requirements
- 135 IEC 61076-2-101: Connectors for electronic equipment - Product requirements - Part 2-101:
136 Circular connectors - Detail specification for M12 connectors with screw-locking
- 137 IEC 61076-2-109: Connectors for electronic equipment - Product requirements - Part 2-109:
138 Circular connectors - Detail specification for connectors with M12 x 1 screw-locking, for data
139 transmission frequencies up to 500 MHz
- 140 IEC 61076-2-111: Connectors for electronic equipment - Product requirements - Part 2-111:
141 Circular connectors - Detail specification for power connectors with M12 screw
- 142 IEC 61076-2-113: Connectors for electronic equipment - Product requirements - Part 2-113:
143 Circular connectors - Detail specification for connectors with M12 screw locking with power and
144 signal contacts for data transmission with frequency up to 100 MHz
- 145 IEC 61076-2-114: Circular connectors – Detail specification for data and power connectors with
146 M8 screw-locking
- 147 IEC 61076-2-117: Connectors for electronic equipment - Product requirements - Part 2-117: M17
148 Hybrid SPE connectors according
- 149 IEC 61076-3-106: Connectors for electronic equipment - Product requirements - Part 3-106:
150 Rectangular connectors - Detail specification for protective housings for use with 8-way shielded
151 and unshielded connectors for industrial environments incorporating the IEC
- 152 IEC 61076-3-117: Connectors for electronic equipment – Product requirements – Part 3 117:
153 Rectangular connectors – Detail specification for protective housings for use with 8-way shielded
154 and unshielded connectors for industrial environments incorporating IEC 60603-7 series interface
155 – Variant 14 related to IEC 61076-3-106 – Push-pull coupling
- 156 IEC 61076-3-119 Connectors for electrical and electronic equipment - Product requirements - Part
157 3-119: Rectangular connectors - Detail specification for shielded and unshielded, free and fixed
158 10-way connectors with push-pull coupling for industrial environments for data transmission with
159 frequencies up to 100 MHz
- 160 IEC 61076-3-122: Connectors for electrical and electronic equipment - Product requirements - Part
161 3-122: Detail specification for 8-way, shielded, free and fixed connectors for I/O and data
162 transmission with frequencies up to 500 MHz and current-carrying capacity in industrial
163 environments
- 164 IEC 61076-3-123: Rectangular connector. Detail specification for hybrid connectors for industrial
165 environments, for power supply and fibre optic data transmission, with push-pull locking
- 166 IEC 61076-3-124: Connectors for electrical and electronic equipment - Product requirements –
167 Part 3-124: Rectangular connectors – Detail specification for 10-way, shielded, free and fixed
168 connectors for I/O and data transmission with frequencies up to 500 MHz
- 169 IEC 61076-3-126: Connectors for electrical and electronic equipment - Product requirements - Part
170 3-126: Rectangular connectors - Detail specification for 5 pole power connectors for industrial
171 environments with push-pull locking
- 172 IEC 61156-1: Multicore and symmetrical pair/quad cables for digital communications - Part 1:
173 Generic specification
- 174 IEC 61156-5: Multicore and symmetrical pair/quad cables for digital communications – Part 5:
175 Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Horizontal floor
176 wiring – Sectional specification

177	IEC 61156-6: Multicore and symmetrical pair/quad cables for digital communications - Part 6:
178	Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz - Work area wiring
179	- Sectional specific
180	IEC 61156-1: Multicore and symmetrical pair/quad cables for digital communications – Part 11:
181	Symmetrical single pair cables with transmission characteristics up to 600 MHz – Horizontal floor
182	wiring – Sectional specification
183	IEC 61156-12: Multicore and symmetrical pair/quad cables for digital communications – Part 12:
184	Symmetrical single pair cables with transmission characteristics up to 600 MHz – Work area wiring
185	– Sectional specification
186	IEC 61300-series Fibre optic interconnecting devices and passive components - Basic test and
187	measurement procedures
188	IEC 61300-2-2: Fibre optic interconnecting devices and passive components - Basic test and
189	measurement procedures - Part 2-2: Tests - Mating durability
190	IEC 61300-2-4: Fibre optic interconnecting devices and passive components - Basic test and
191	measurement procedures - Part 2-4: Tests - Fibre or cable retention
192	IEC 61300-3-4: Fibre optic interconnecting devices and passive components - Basic test and
193	measurement procedures - Part 3-4: Examinations and measurements - Attenuation
194	IEC 61300-3-34: Fibre optic interconnecting devices and passive components - Basic test and
195	measurement procedures - Part 3-34: Examinations and measurements - Attenuation of random
196	mated connectors
197	IEC 61326-3-1-series: Electrical equipment for measurement, control and laboratory use - EMC
198	requirements - Part 3-1: Immunity requirements for safety-related systems and for equipment
199	intended to perform safety-related functions: functional safety - General industrial applications
200	IEC 61753-series: Fibre optic interconnecting devices and passive components performance
201	standard
202	IEC 61754-2: Fibre optic connector interfaces - Part 2: Type BFOC/2,5 connector family
203	IEC 61754-4: Fibre optic interconnecting devices and passive components - Fibre optic connector
204	interfaces - Part 4: Type SC connector family
205	IEC 61754-20: Fibre optic connector interfaces – Part 20: Type LC connector family
206	IEC 61754-24: Fibre optic connector interfaces, - Part 24: Type SC-RJ connector family
207	IEC 61754-24-11: Fibre optic interconnecting devices and passive components - Fibre optic
208	connector interfaces - Part 24-11: Type SC-RJ connectors with protective housings based on IEC
209	61076-3-117
210	IEC 61754-24-21: "Fibre optic interconnecting devices and passive components - Fibre optic
211	connector interfaces - Part 24-21: Type SC-RJ connectors with protective housings based on IEC
212	61076-3-106, variant 06"
213	IEC 61784-5-3: Industrial communication networks - Profiles - Part 5-3: Installation of fieldbuses -
214	Installation profiles for CPF 3
215	IEC 61918: Industrial communication networks - Installation of communication networks in
216	industrial premises
217	IEC 61935-2: Specification for the testing of balanced and coaxial information technology cabling
218	- Part 2: Cords as specified in ISO/IEC 11801 and related standards
219	IEC 61984: Connectors - Safety requirements and tests
220	IEC 62012-1: Multicore and symmetrical pair/quad cables for digital communications to be used in
221	harsh environments - Part 1: Generic specification

- 222 IEC 62153-4-12: Metallic communication cable test methods - Part 4-12: Electromagnetic
 223 compatibility (EMC) - Coupling attenuation or screening attenuation of connecting hardware -
 224 Absorbing clamp method
- 225 IEC 63171-6: Connectors for electrical and electronic equipment – Part 6: Detail specification for
 226 2-way and 4-way (data/power), shielded, free and fixed connectors for power and data
 227 transmission with frequencies up to 600 MHz
- 228
- 229 IEC 63171-7: Connectors for electrical and electronic equipment - Part 7: Detail specification for
 230 4-way to 6-ways plus PE or FE (data/power) shielded, free and fixed circular connectors for
 231 balanced single-pair data transmission current-carrying capacity: mechanical mating information,
 232 pin assignment and additional requirements for type 7
- 233 IEC 61754 series – Fibre Optic Connector Interfaces: Defines physical interface dimensions for
 234 specific connector types. Relevant parts are:
- 235 • IEC 61754-24: *Type SC-RJ connector family* – duplex 2.5 mm ferrule industrial connector.
 - 236 • IEC 61754-24-21: *SC-RJ connectors with protective housings* – SC-RJ in ruggedized
 237 IP65/67 push-pull housing.
 - 238 • IEC 61754-20: *Type LC connector family* – LC simplex & duplex connectors.
 - 239 • IEC 61754-4: *Type SC (SC-Duplex) connector family* – SC simplex/duplex connectors.
 - 240 • IEC 61754-2: *Type BFOC/2.5 (ST) connector family* – BFOC (ST) bayonet connectors.
- 241 IEC 61076 series – Connector Housings for Industrial Environments:
- 242 • IEC 61076-3-106 / -107: *Push-Pull connector housings* (Type A and Type B variants) for
 243 data connectors (e.g. used with SC-RJ push-pull inserts).
 - 244 • IEC 61076-3-123: *Industrial connectors – Push-Pull LC hybrid connector* – defines a
 245 rugged IP67 connector incorporating duplex LC fibre and optional power contacts in a
 246 single hybrid interface for harsh environments.
- 247 IEC 60793 series – Optical Fibre Specifications & Test Methods:
- 248 • IEC 60793-2: *Product specifications for optical fibres*. It classifies fibre types into
 249 categories (e.g. A1 for multimode, A2 for multi-core, A3 for PCF, A4 for POF, B for single-
 250 mode) and lists performance specifications.
 - 251 ○ IEC 60793-2-40: *Category A4 – Plastic Optical Fibres (POF)* – defines 980/1000 µm
 252 step-index POF (A4a) and newer high-bandwidth graded-index POF types.
 - 253 ○ IEC 60793-2-30: *Category A3 – Plastic Clad Fibres (PCF)* – defines 200/230 µm
 254 polymer-clad silica fibres.
 - 255 • IEC 60793-1 series: *Optical fibre test methods*, including:
 - 256 ○ IEC 60793-1-40 (attenuation measurement),
 - 257 ○ IEC 60793-1-41 (bandwidth measurement),
 - 258 ○ IEC 60793-1-20 (numerical aperture measurement),
 - 259 ○ IEC 60793-1-44 (cut-off wavelength for single-mode fibres), and others – use latest
 260 editions.
- 261 IEC 60794 series – Fibre Optic Cable Specifications and Tests:
- 262 • IEC 60794-1-2: *Generic fibre optic cable test procedures* – methods for
 263 mechanical, environmental and electrical tests on optical cables.

- IEC 60811-203: *Common test methods for insulation and sheath materials* – Part 203 covers measurement of outer cable dimensions. IEC 60811-203:2012 remains current; it replaced earlier methods in IEC 60811-1-1.

Ethernet & PROFINET Transmission Standards (IEEE/IEC):

- IEEE 802.3: The Ethernet standard defines the *optical Physical Layer* for Ethernet-based networks including PROFINET. Key specifications are:
 - *100BASE-FX* (Fast Ethernet over fibre, typically 1300 nm LED on multimode, up to 2 km).
 - *1000BASE-SX/LX* (Gigabit Ethernet over multimode (SX) at 850 nm, typically 275–550 m range; and over single-mode (LX) at 1300 nm, up to 5–10 km).
 - *1000BASE-RH (IEEE 802.3bv-2017)* – Gigabit Ethernet over POF, supporting ~40–50 m on latest high-bandwidth POF.
- IEC 61158 / IEC 61784-5 series: Installation profiles for fieldbus and industrial Ethernet systems (e.g. PROFINET). In particular IEC 61784-5-3 (PROFINET specific cabling and connectivity guidelines) should be consulted for additional normative installation requirements beyond the scope of this document.

1.4 Definitions and Abbreviations

1.4.1 Terms and definitions

For definitions and abbreviations see IEC 61918 and IEC 61784-5-3.

For the purposes of this document, the following terms and definitions apply:

GPC: PROFINET General Passive Components

SPC: PROFINET Specific Passive Components

LPC: PROFINET Legacy Passive Components

2 Component Classification and Certification

2.1 Supported Physical Layers

The physical layers for PROFINET in factory automation application areas are based on 4/2/1-pair Ethernet and fibre optical Ethernet infrastructure.

Certain physical layers are possible to realize a PROFINET communication. Users can also deploy different types of PROFINET cabling. Planers should consider the different characteristics, advantages, and disadvantages for their project.

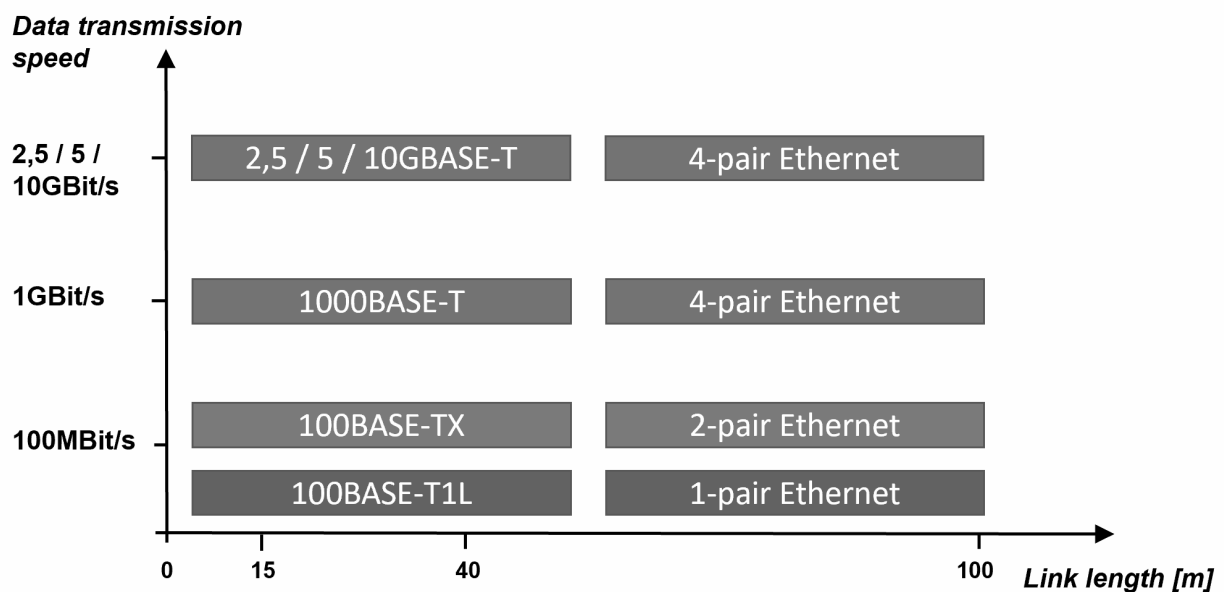


Figure 1: Copper based communication for PROFINET

299 **Table 1: PROFINET supported physical Layers**

Datarate	Copper Based			Fibre Based		
	4-Pair-Ethernet	2-Pair-Ethernet	1-Pair-Ethernet	POF	Single- mode	Multi-mode
100 MBit/s	max. 100m	max. 100m	max. 100 m ^{a)} (T1-B)	max. 50 m	up to 4000 m	up to 2000 m
1000 MBit/s	max. 100m		(T1-B)		max. 10000 m	max. 1000 m
10 GBit/s	max. 100m				max. 10000 m	max. 1000 m
a) T1-B limited to 600 MHz bandwidth in accordance with ISO/IEC 11801-1 AMD 1) Note: Screened cables meeting the requirements of 6.2.7 and 6.2.8 (minimum Type Ib); ANEXT is proven by design according to IEC 61156-11						

300
301
302 **2.2 Component Classification: Cables & GPC Connectors**303 For all cables and connectors used in PROFINET Cabling Systems or as part of a PROFINET
304 device, the following rules apply.

305 Cables and connectors are categorized according to their priority of use:

- 306 1. **PROFINET General Passive Component (GPC)** are components which represent the
307 default solution for all PROFINET installations and PROFINET devices. Interoperability,
308 convenience of use for all implementations and conformance with all technical aspects of
309 this guideline are provided. Deviations shall only be accepted in a few unavoidable cases
310 (specific application areas).
- 311 2. **PROFINET Specific Passive Component (SPC)** are solution for a designated application
312 area or several application areas that cannot be covered by the GPC in a technically and
313 economically reasonable way. Adaptors with specific cables and connectors to General
314 cables and connectors (GPC) shall be provided to deploy implementations which are in
315 conformance with all technical aspects of this guideline.
- 316 3. **PROFINET Legacy Passive Component (LPC)** Solution are only supported for legacy
317 PROFINET installations and PROFINET devices that are not covered by the preferred
318 cables and connectors (GPC). These connectors and cables will be discontinued and are
319 not General for new developments. To ensure a high interoperability of PROFINET
320 installations, adaptors shall be used to interconnect devices with legacy connectors to the
321 GPC infrastructure. The implementations shall be in conformance with all technical
322 aspects of this guideline to be in conformance with PI rules and regulations.

SPC can be seen as components that are very well adapted to special applications.

GPCs are broader in their area of application but can be inferior to an SPC in special applications.

Not listed Components from previous guidelines are declared as LPC connectors and may therefore continue to be used for existing devices.

Table 2: List of PROFINET Connectors with Component Classification

Physical Layer	Connector Type	Connector Classification
1 pair	Connector 1-pair Data Inside IP20 Rectangular 2-way	GPC
	Connector 1-pair Data Outside M12 Type 1 2-way	GPC
	Connector 1-pair Data Outside M8 Type 1 2-way	GPC
	Connector 1-pair Hybrid Outside M8	SPC
	Connector 1-pair Hybrid Outside M12 Type I	SPC
	Connector 1-pair Hybrid Outside M12 Type II	GPC
	Connector 1-pair Hybrid Outside M12 Type IV	SPC
	Connector 1-pair Hybrid Outside M17 Type 1B	SPC
	Connector 1-pair Hybrid Outside M23 Type 1	SPC
	Connector 1-pair Hybrid Outside M40 Type 1	SPC
2- pair	Connector 2-pair Data Inside Type RJ 45	GPC
	Connector 2-pair Data Outside Type RJ45 Push Pull	SPC
	Connector 2-pair Data Outside M12 D coded	GPC
	Connector 2-pair Data Outside M8 D coded	SPC
	Connector 2-pair Data Inside Type Mini-IO	SPC
	Connector 2-pair Data Inside Type Ix-Industrial	SPC
	Connector 2-pair Hybrid Outside Type M12 Y coded Type 4	SPC
	Connector 2-pair Hybrid Outside Type M17 Type B	SPC
	Connector 2-pair Hybrid Type M23 Type 2	SPC
4 pair	Connector 2-pair Hybrid Type M40 Type 2	SPC
	Connector 4-pair Data Inside Type RJ 45	GPC
	Connector 4-pair Data Outside Type RJ45 Push Pull	SPC
	Connector 4-pair Data Outside Type M12 X coded	GPC
	Connector 4-pair Data Inside Type Mini-IO	SPC
FO	Connector 4-pair Data Inside Type Ix-Industrial	SPC
	Connector FO Inside Type SC-RJ	SPC
Power 24 Volt	Connector FO Inside Type LC	GPC
	Connector Power Outside Type M12 L-coded	GPC

2.2.1 Lifecycle management

The lifecycle management follows the scheme in Figure 2 – Procedure for annual Lifecycle management and new components with the mentioned steps.

Passive components can be classified according to the following scheme:

1. GPC shall be adopted from the previous version of this guideline.
2. New GPC shall be selected from SPC.
3. New SPC shall be selected following the “Procedure for proposed SPC”
4. New LPC shall be selected by CB-PG1 following the “Procedure Lifecycle management of GPC, SPC and LPC”

5. The announcement of lifecycle changes shall be performed by a new edition of this guideline.

2.2.1.1 Procedure the Lifecycle management of GPC, SPC

1. The CB-PG1 initiates an assessment (A1), (A2)
2. It would be proposed by CB-PG1, whether the existing content will remain or moved to another category based on the previous table. (C1), (C2)
3. New components for SPC will be included based on the outcome from (B5)
4. The new proposed table has to be confirmed or rejected by the Advisory Board. (C3)
5. In the positive case, a new edition of the guideline would be created, following the procedure of the PI-Review (C5) (C6)
6. In the negative case, the procedure starts again including guidance from the Advisory Board or their agents. (C4)

2.2.1.2 Procedure for proposed SPC

1. A new SPC can be proposed by WG's, users or vendors (B1) for a specific application area.
2. A call for interest would be initiated in CB-PG1 to describe the Use-Case/Application Area in the respective form (B2)
 - a. The proposal has to be presented to CB-PG1. The proposer can be supported by a cable or connector manufacturer.
 - b. The proposer has to declare why existing cables or connectors cannot fulfil the economic and technical requirements. A maximum of two cable or connector solutions may exist in the same application area.
3. If CB-PG1 supports the inclusion of the new application area, a detailed description of the use case, the proposed component and technical and economic feasibility would be prepared. Otherwise, the activities are stopped. (B2), (B3), (B4), (B5)

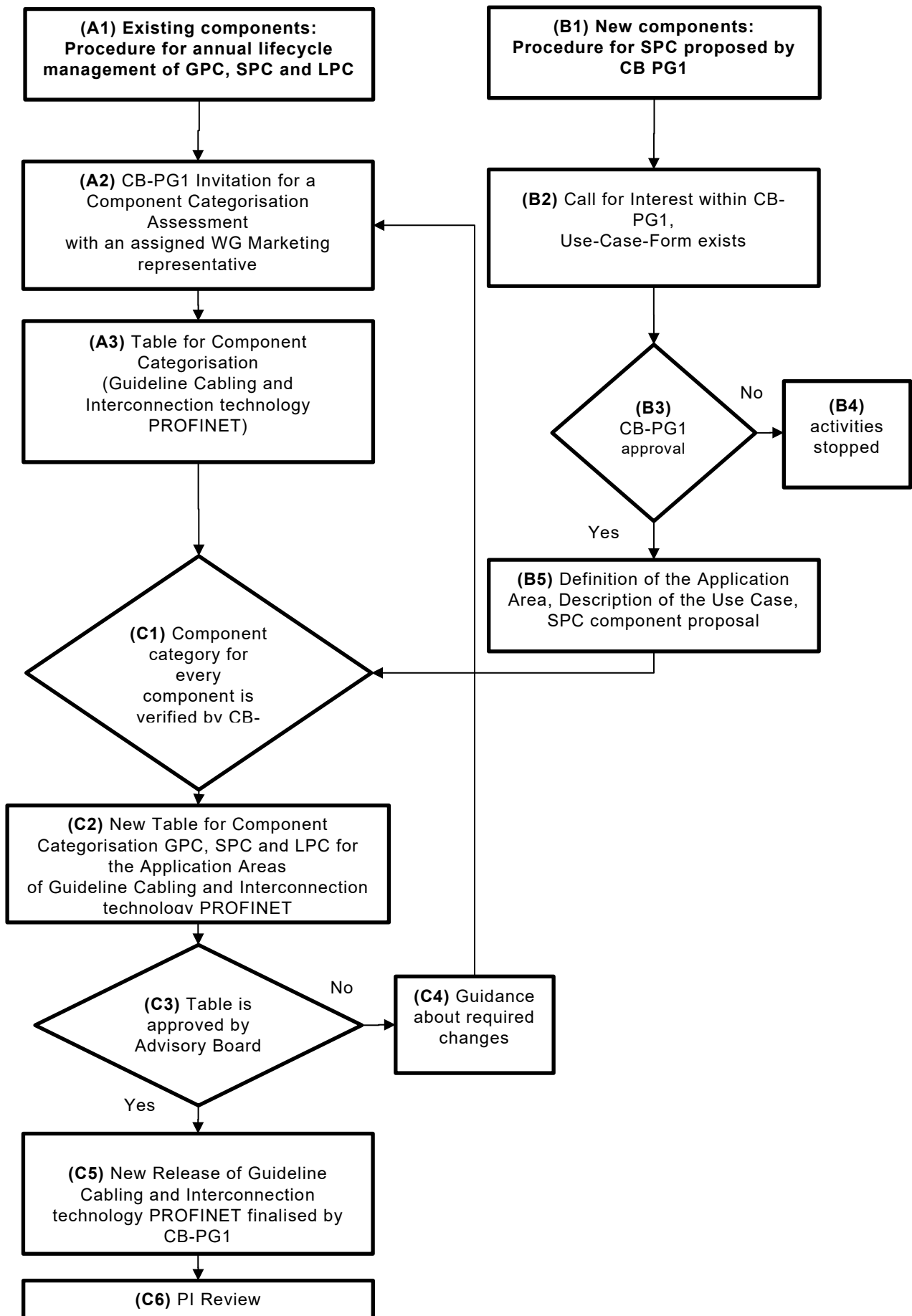


Figure 2: Procedure for Lifecycle management and new components

2.2.1.3 Certification of PROFINET-Devices

For the release of a certificate as PROFINET-device the following prerequisites shall be fulfilled:

- The device is equipped with an GPC, SPC connector interface as described in this guideline.
- The devices shall be tested with GPC, SPC connectors and cables in conformance with this guideline.
- New device developments shall be started either with a GPC or an SPC connector based on the current version of this guideline.
- Extensions of an existing device family with an LPC connector can use the same LPC connector.

If the application requires a connector that cannot technically be accommodated by any of the PROFINET connectors of the GPC or SPC class, an adaptation as described in the chapter 2.4.1 on adaptation is possible. In any case, certification of the device requires the use of a GPC or SPC connector. Any adaptation required for this purpose must be an integral part of the device.

2.3 Environment Classification

The environmental conditions and the PROFINET installation classes are defined in IEC 61784-5-3.

High reliability of industrial installations in production industry and field areas require reliable, save, robust and EMC-resistant components.

Meeting the high demands in all areas of the industrial sector, a differentiation between "inside" and "outside" protected areas needs to be made:

- **Inside enclosure** refers to the environment found in control stations, electronic rooms and inside cabinets.
- **Outside enclosure** refers to higher demands regarding dust, moisture, vibration, EMC etc. that exist in the industrial area when used outside an enclosure.

Table 3: Environments Inside Enclosure and Outside Enclosure

	Inside enclosure	Outside enclosure
Mechanical		
Shock/bump ^{a)} Peak acceleration	IEC 60512-6-3, test 6c 20 g / 11 ms 3 per axis in both directions	IEC 60512-6-3, test 6c 50 g / 11 ms 3 per axis in both directions
Vibration 10-500 Hz	IEC 60512-6-4, test 6d 0.35 mm or 5g	IEC 60512-6-4, test 6d 0.35 mm or 5g
Ingress Protection		
Class	IEC 60529:1989 + A1:1999 + A2:2013 IP20	IEC 60529:1989 + A1:1999 + A2:2013 IP65 and IP67
Climatic		
Ambient temperature	0°C to +70°C ^{b)}	-20°C to +70°C ^{b)}
Electromagnetic		
Transfer Impedance	See components selection	
^{a)} Bump: the repetitive nature of the shock experienced by the channel shall be taken into account.		
^{b)} An additional heating by POE has to be considered by the user.		

2.4 PROFINET Cabling Systems

The guideline describes individual cabling systems that shall be used for PROFINET.

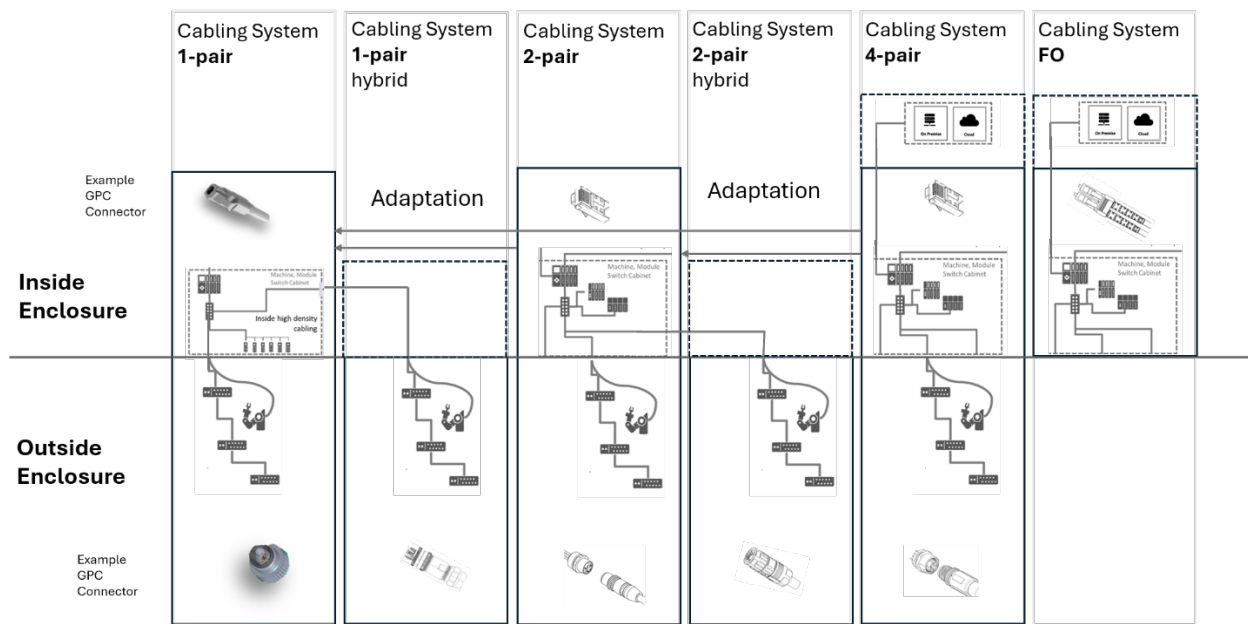


Figure 3: The different PROFINET cabling systems

The different cabling systems correspond to the physical layers. Each cabling system is described separately in the second part of the guideline.

Mixing different cabling systems is not supported.

Devices carrying a different connector are integrated by active or passive converters.

Adapters are also described in the chapter of the respective cabling system.

2.4.1 Adaptation to Cabling Systems

Cabling systems should be viewed as integrated ecosystems. Therefore, all devices must be fitted with the connectors specified for the cabling system. Adapters are available to enable the integration of devices with other PROFINET connectors. It should be noted that, when using the component-based approach, an adapter can increase the number of pairs. An adapter may require an active network component. Purely passive adapters can only be used within a single physical layer.

2.4.2 End-to-End (E2E) link assemblies and Component Approach for 2 and 4 pair cabling

The end-to-end link is the central element in PROFINET cabling and is used in 2 and 4 pair copper-based cabling.

PROFINET cabling components are specified in such a way that the component approach is possible. The component approach refers to GPC and SPC components.

2.4.2.1 E2E link without interconnections

Figure 4 shows an E2E link without interconnections of 100 m length with connectors installed directly at both ends of the cable.

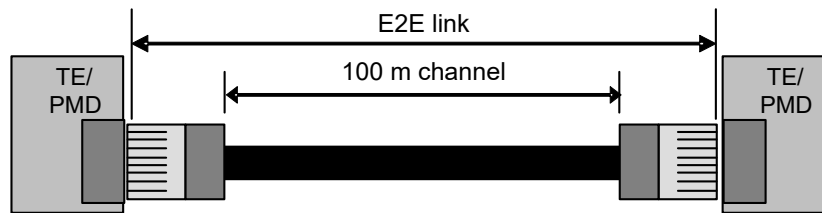


Figure 4: E2E link without interconnections

2.4.2.2 E2E link with interconnections

Figure 5 shows an assembled End-to-End link of 100 m length, containing an intermediate plug connection established with a bulkhead.

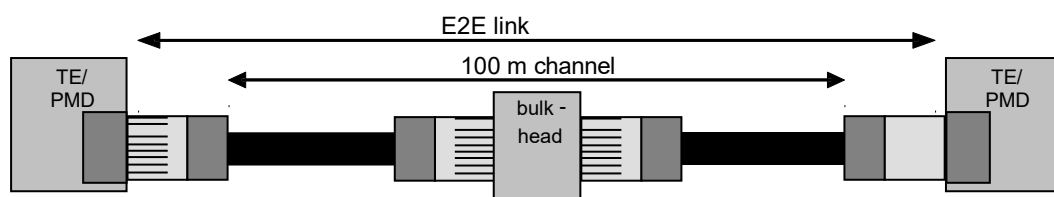


Figure 5: E2E link with interconnections

2.4.2.3 Procedures for measurement of the End-to-End link

The traditional definition of the channels excludes the contribution of the end connections (connections to the application or the field tester) to the overall NEXT. To allow for two alternative but functional equivalent test method values for the End-to-End Link need to be defined to support the different test scenario.

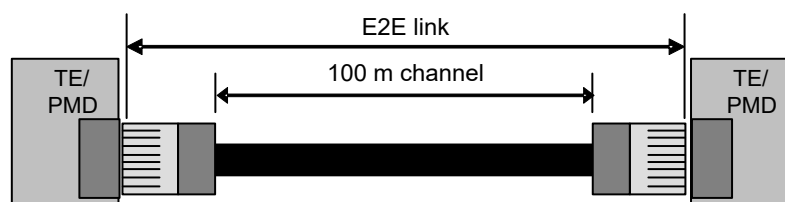


Figure 6: Definition of the reference plain

The procedures of the E2E link measurement are specified in ISO/IEC 14763-4.

2.4.2.4 Component Approach for 2-pair and 4-pair cabling

An E2E Link for the 2-pair and 4-pair cabling systems allows a defined number of connector pairs. This component approach refers to GPC and SPC connectors. If simple rules are adhered to and PROFINET components are used, adequate link performance is achieved with flawless installation.

The component approach with a defined number of components is only supported for 2-pair and 4-pair cabling systems, for hybrid systems the power cabling must also be taken into account.

The following table shows the possible E2E configurations:

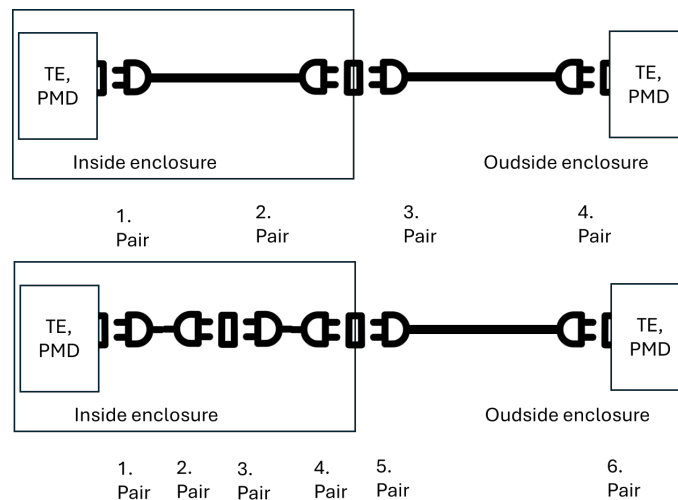


Figure 7: Number of Interconnections in an PROFINET E2E-Link

The transmission distance is limited to 100 m.

The E2E Link is a simplified solution that, in practice, ensures reliable PROFINET cabling.

2.4.3 PROFINET Cord Sets

Cord sets are pre-assembled units consisting of cable and connectors.

2.4.3.1 PROFINET Standard cord sets

These are pre-assembled units made from standard cabling components. This means the use of a connector and a cable of class GPC or SPC to create a pre-assembled unit. The same rules must be observed as when using individual components.

PROFINET cord sets represent PROFINET components and are marked as such (see chapter Cord sets of the individual physical layers).

2.4.4 PROFINET Cabinet cord sets

These cord sets are only available for inside cabinet use. They are therefore only used for cabling devices within an enclosure. Due to the resulting reduced lengths, special cables are required.

The connectors to be used must have a mating face in accordance with the approved GPC or SPC components. As cables are also used here that are not available as individual components for field assembly, the properties of the cables to be used for the cabinet cord sets are listed separately in this chapter.

Cables used for cabinet cord sets that do not meet the requirements of standard cables must not be marketed individually as PROFINET components.

PROFINET cabinet cord sets represent PROFINET components and are marked as such (see chapter Cord sets of the individual physical layers).

3 Guide to use

3.1 Cabling Systems for Application Areas

PROFINET Passive Components are designed for the PROFINET application areas.

Following application areas are defined for PROFINET. These application areas are relevant for PROFINET General Passive Component (GPC) Components as well as PROFINET Specific Passive Component (SPC) Solution.

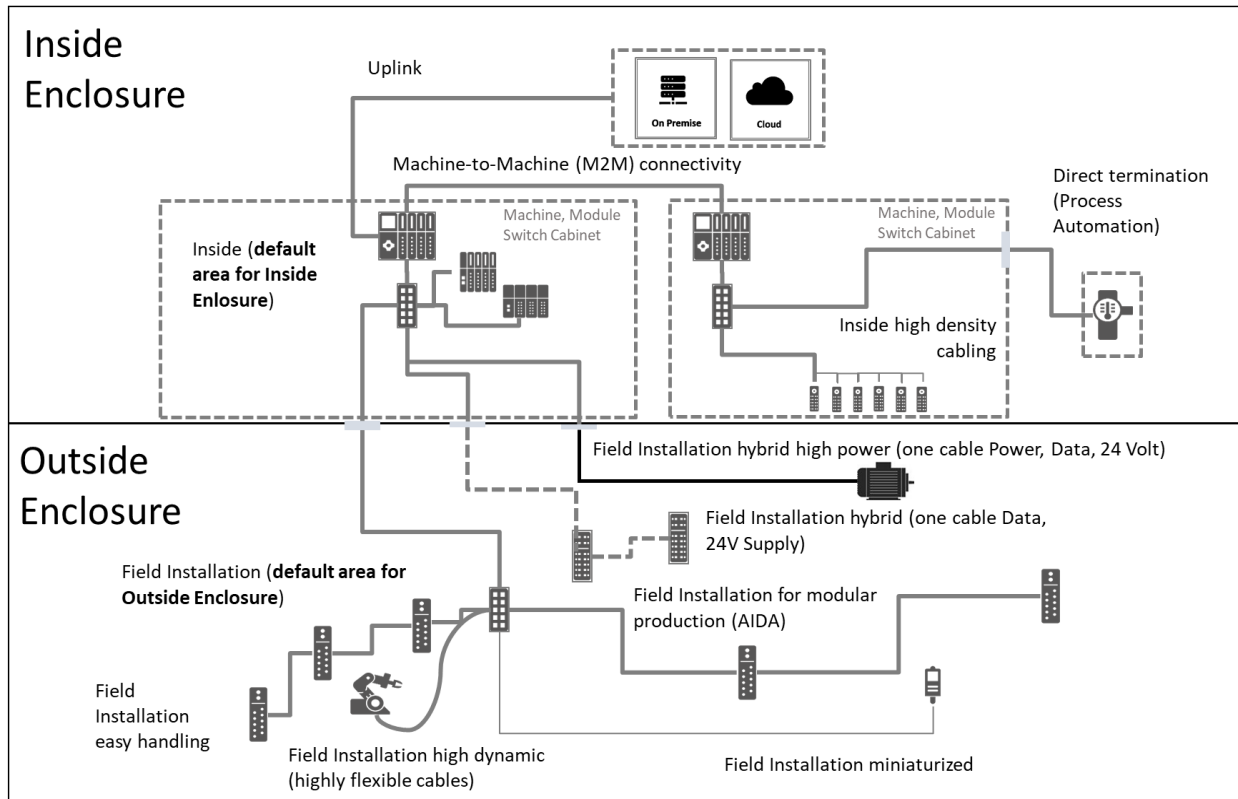


Figure 8: Cabling Landscape with allocation of application areas

Table 4: Supported Application Areas

Environment:	Application Area:
Inside Enclosure	Uplink
	Machine-to-Machine (M2M)
	Inside cabling (default area for Inside Enclosure)
	Inside high-density cabling
	Direct termination (Process Automation)
Outside Enclosure	Field Installation (default area for Outside Enclosure)
	Field Installation for modular production
	Field Installation hybrid
	Field Installation easy handling
	Field Installation hybrid high power
	Field Installation high dynamic
	Field Installation miniaturized

In Table 4 are the different supported Application Areas listed. Future Applications will be added in new versions of the guideline.

PROFINET devices and uplink cabling shall be compatible and according to the connector definition, which are listed below.

The default application areas are Inside Cabling and Field Installation, which correspond directly to the inside enclosure and outside enclosure environment.

All components of the application area inside enclosure and outside enclosure shall fulfil at least the environmental requirements of Table 3: Environments Inside Enclosure and Outside Enclosure.

3.2 Application Areas

3.2.1 Inside Enclosure

3.2.1.1 Uplink

The Uplink provides data from the field level to the level IT systems such as the Manufacturing Execution System (MES). Uplinks are essential parts of industrial premises and as such they have to be compatible to structured premises cabling. This communication typically requires data to be transmitted at a very high data rate over a large distance up to 1000 m and thus, it predominantly uses fibre optical (FO) cabling.

3.2.1.2 Machine-to-machine (M2M)

M2M connectivity enables machinery, robots and devices to exchange information and utilizes an End-to-End link with high bandwidth up to 10 Gbit/s preferable over 4-pair balanced copper cabling.

3.2.1.3 Inside cabling

The application area inside cabling is the default environment for any cabling that starts on a device within a protected atmosphere of a control cabinet or other housing (Inside enclosure) and ends on a device within an application area inside cabling.

3.2.1.4 Inside high-density cabling

Peripheral equipment typically incorporates cabinets accommodating devices such as a local control unit and I/O systems. The dimensions of peripheral cabinet device modules are getting smaller to enable high packaging densities in the equipment's racks. Distributed peripheral equipment with inside high-density Cabling communication utilizes an End-to-End link with High Bandwidth up to 10 Gbit/s preferable over 4pair balanced copper cabling.

3.2.2 Outside Enclosure

3.2.2.1 Field Installation

The application area field installation is the default environment for any cabling that starts on a device outside the protected atmosphere of a control cabinet or other housing (Outside Enclosure) and ends at a such a device. It includes an End-to-End link that starts on a device in the Outside Enclosure and ends at a device in a cabinet (Inside Enclosure).

3.2.2.2 Field Installation for modular production

Modular production systems have extended requirements for field installation. In addition to simple installation and commissioning, this application area primarily requires a very quick and easy exchange of automation components.

3.2.2.3 Field Installation of hybrid cable and connector (one data cable and one 24V Supply)

For control units and devices in the outside field, a space-saving and easy connection option is required. This can be realized by using a single cable solution. The device is connected via a hybrid cable and a hybrid plug, which provides elements for transmitting power with 24 V as well as data.

3.2.2.4 Field Installation easy handling

In applications where an easy exchange of components is required, additional requirements are placed on the Field Installation.

Connectors with push-pull locking mechanism give special advantage to all applications that require quick and simple handling.

3.2.2.5 Field Installation hybrid high power

In the field, it may be necessary to supply devices with a high power, for example provided by an inverter. To avoid high cabling effort by using several separate cables for the encoder system, for data transmission and for the power transfer, space-saving solutions are favoured. For different power levels different SPCs are defined.

3.2.2.6 Field Installation high dynamic

In several applications like robotics or assembly lines cables are moved during operation. Machines parts or even the full machine might do permanent repeated movements in operation.

For this application selected PROFINET components are specified (e.g. highly flexible cables).

3.2.2.7 Field Installation miniaturized

The size of the automation devices for example in IIoT (Industrial Internet of Things) applications is significantly reduced. This small automation devices will also be connected to a PROFINET network.

3.3 Assignment of Cabling Systems to Application Areas

The assignment of application areas to cabling ecosystems is shown in Table 5.

However, certain cabling systems are suitable for individual application areas.

The following table is a recommendation on which cabling systems can be used for which application area. It is important that the cabling system is seen as a complete ecosystem. The devices used must be equipped with the interface assigned to the cabling system or connected to the ecosystem via an adapter solution.

More information can be found in the chapters on cabling systems.

The preferred assignment is shown in bold and underlined.

Table 5: Assignment of application areas to cabling ecosystems.

Environment Application Area	Ecosystems Cabling System	1- pair	1-pair hybrid	2- pair	2-pair hybrid	4- pair	FO
Inside Enclosure	Uplink					X	<u>X</u>
	Machine-to-Machine (M2M)					<u>X</u>	X
	Inside cabling (default area for Inside Enclosure)	X		X		<u>X</u>	
	Inside high-density cabling	X		X		X	
Outside Enclosure	Field Installation (default area for Outside Enclosure)	<u>X</u>		<u>X</u>		X	
	Field Installation for modular production			X		X	
	Field Installation hybrid		X		X		
	Field Installation easy handling	X	X	X			
	Field Installation hybrid high power				<u>X</u>		
	Field Installation high dynamic			X			
	Field Installation miniaturized	X	X		X		

B: PROFINET Cabling Systems

4 Cabling System 1-pair

4.1 Scope

The industrial 1-pair cabling system, based on Single Pair Ethernet (SPE) technology, offers a streamlined and robust solution for delivering Ethernet data and Power over DataLine (PoDL) with up to 50 Watts through a single twisted pair cable. Specifically engineered for demanding industrial environments—both in the field and within control cabinets—these cables and connectors enable direct connectivity between PROFINET devices, sensors, and the industrial Ethernet backbone, eliminating the need for protocol converters or gateways. SPE’s simplified two-wire architecture ensures reliable signal integrity, supports long transmission distances, and complies with stringent safety standards, making it ideal for modern IIoT applications in miniaturized applications.

The PROFINET over SPE General Passive Components (GPC) are designed for PROFINET-defined transmission speeds in point-to-point applications and support different cable diameters optimized either for high packing density or long transmission distances. Both field-assembly connectors and pre-manufactured patch cables are fully permitted in PROFINET environments. The system can be used in control cabinets, in-field installations, and hybrid setups, providing a universal solution for SPE. Standardization in IEC 63171-7ed.2 ensures a consistent and interoperable mating interface across various applications.

4.1.1 System landscape

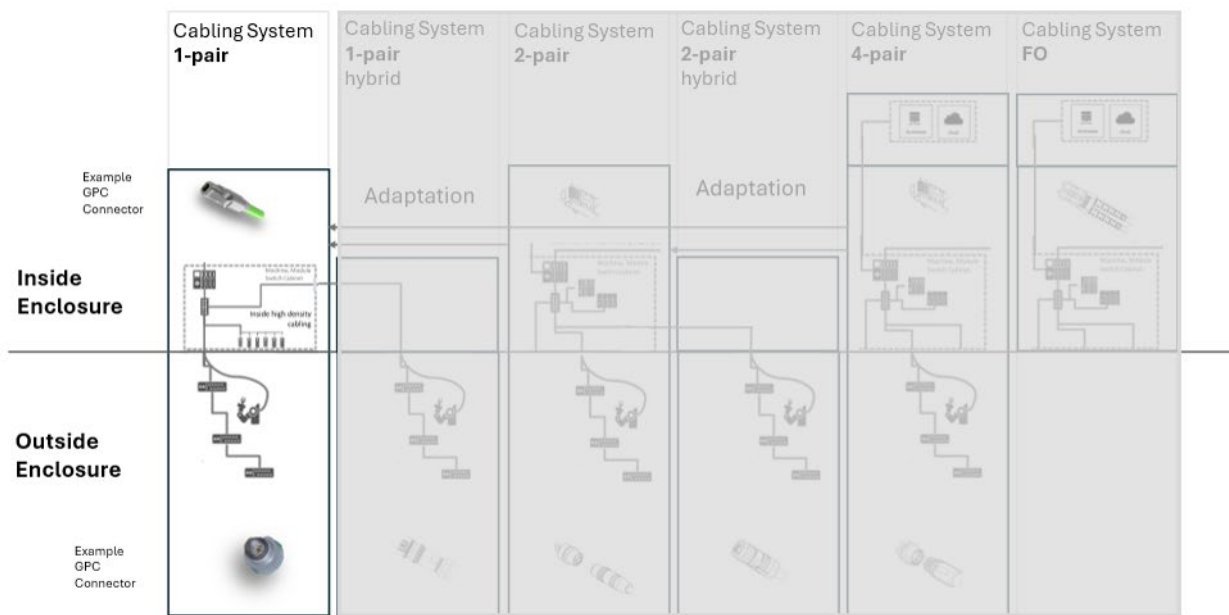


Figure 9: The PROFINET cabling system 1-pair

Single Pair Ethernet (SPE) technology is well-suited for a wide range of industrial applications where space, efficiency, and reliability are critical. It is commonly used in Distributed Control Systems (DCS) to streamline communication between controllers and field devices. SPE also facilitates I/O module connections by transmitting Ethernet over a simplified cabling system. Within industrial communication networks, SPE enables real-time data exchange across various systems. Additionally, it supports power distribution to control devices up to 50 Watt, reducing the need for

separate power lines. For critical systems, SPE allows for redundant communication paths, ensuring continuous operation and enhanced fault tolerance.

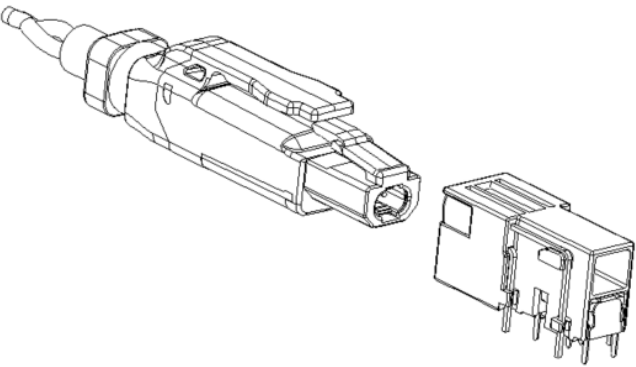
4.1.2 Physical layer References

- IEEE
- IEEE 802.3 cg (10BASE-T1L)
- IEEE 802.3 dg (100BASE-T1L)
- IEEE 802.3 bu/cg (Power over DataLine PoDL)
- ISO/IEC
- ISO/IEC 11801-1
- ISO/IEC 11801-3
- ISO/IEC 11801-6

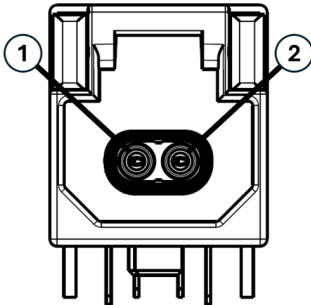
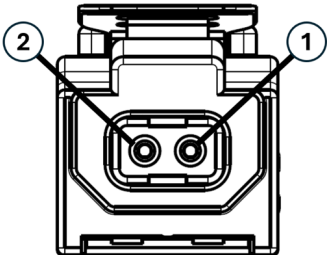
4.2 Connectors

4.2.1 Connector Type IP20 DATA Connector Type I

Table 6: IP20 DATA Connector Type I

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
Application Type:	Point to point using cable diameters AWG 26 - 22 optimized for high packing density and multiport applications
IEC Standard:	IEC 63171-7 Ed.2 IP20 Rectangular Type I
Figures (technical drawings):	
Product Example (picture):	

631

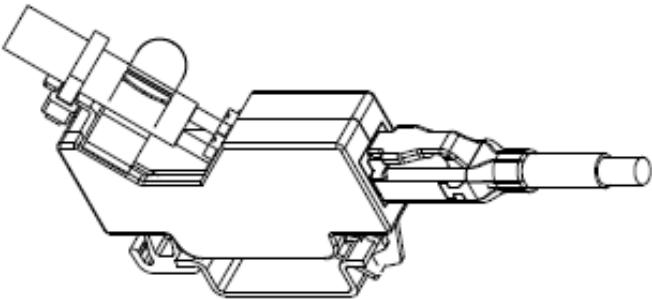
Standard/Requirement			Value	
Mechanical				
Mating cycles (mating & unmating)			750 mating cycles according to IEC 63171	
Electrical				
Rated current			2 A	
Transmission performance			IEC 63171-7 ED.2 Category B	
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
BI_DA+	1 ^a	Blue		
BI_DA-	2 ^b	White		
a PoDL +				
b PoDL -				

632

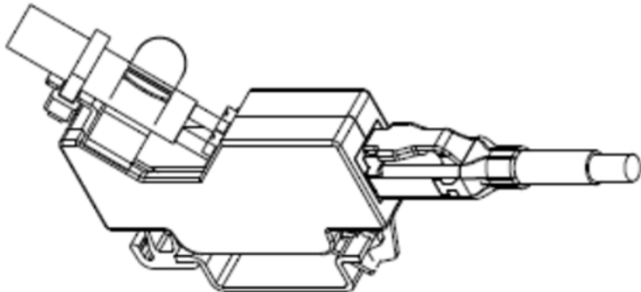
633

4.2.2 PROFINET interconnection Module IP20 DATA Connector Type I

Table 7: IP20 DATA Connector Type I

PROFINET Connector Type:	PROFINET General Passive Components (SPC)
Application Type:	PROFINET Interconnection Module for Cable Adaptation The interconnection module is intended to adapt larger cable cross-sections to a connector interface in accordance with IEC 63171-7. It shall provide a suitable transition between field cabling and the standardized connector interface. The module is designed with an angled cable entry. Alternative cable entry configurations may be implemented depending on application requirements. Shield continuity shall be ensured by appropriate mechanisms. Cables with increased cross-section (bigger than 0,34 mm²/ AWG 22) may be used in field installations to support power transmission over extended distances. Where required, the transition into an enclosure shall be realized using suitable cable entry systems such as cable glands, as larger cables may not directly mate with the connector interface. To minimize reflections, cables with equivalent characteristic impedance shall be used. Further details shall be specified by the manufacturer of the interconnection module.
IEC Standard:	IEC 63171-7 Ed.2 IP20 Rectangular Type I
Figures (technical drawings):	

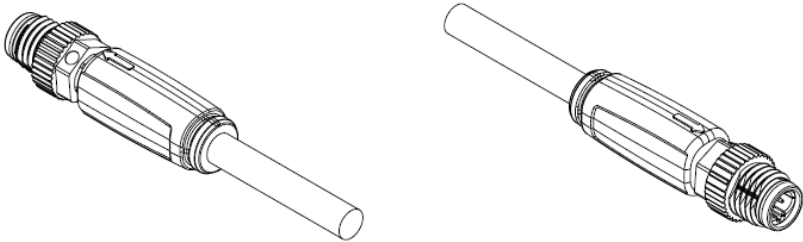
637

Standard/Requirement			Value
Mechanical			
Mating cycles (mating & unmating)			750 mating cycles according to IEC 63171
Electrical			
Rated current			2 A
Transmission performance			IEC 63171-7 ED.2 Category B
Power / Signal	Contact	Colour PROFINET	
BI_DA+	1 ^a	Blue	
BI_DA-	2 ^b	White	
a PoDL +			
b PoDL -			

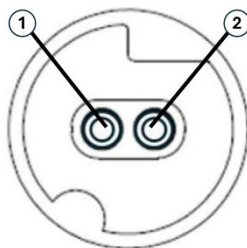
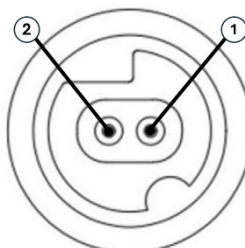
638

4.2.3 Connector Type IP6X M12 for DATA Connector

Table 8: IP6X M12 for DATA Connector

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
Application Type:	Point to point communication for reliable, high-speed data transmission in industrial automation and harsh-environment applications using M12 connectors.
IEC Standard:	IEC 63171-7 Ed.2 M12 2-way Type I
Figures (technical drawings):	
Product Example (picture):	

644

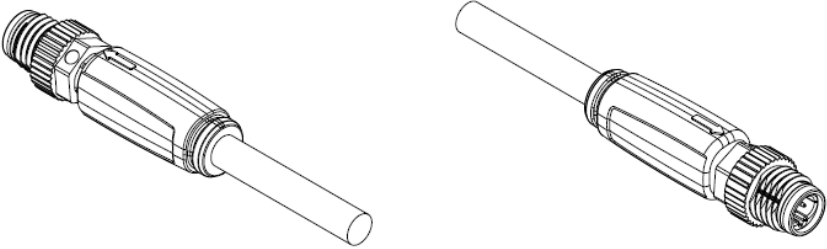
Standard/Requirement			Value	
Mechanical				
Mating cycles (mating & unmating)			100 min. acc. IEC 60512 test 9a	
Electrical				
Rated current			2 A	
Transmission performance			IEC 63171-7 ED.2 Category B	
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
BI_DA+	1 ^a	Blue		
BI_DA-	2 ^b	White		
a PoDL +				
b PoDL -				

645

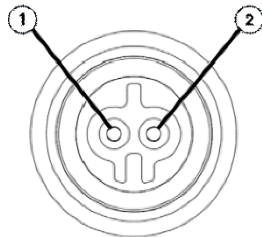
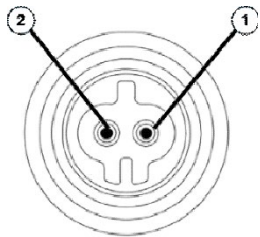
646

4.2.4 Connector Type IP6X M8 for DATA Connector

Table 9: IP6X M8 for DATA Connector

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
Application Type:	Point to point communication for reliable, high-speed data transmission in industrial automation and harsh-environment applications using M8 connectors.
IEC Standard:	IEC 63171-7 Ed.2 M8 2-way Type I
Figures (technical drawings):	
Product Example (picture):	

651

Standard/Requirement			Value	
Mechanical				
Mating cycles (mating & unmating)			100 min. acc. IEC 60512 test 9a	
Electrical				
Rated current			2 A	
Transmission performance			IEC 63171-7 ED.2 Category B	
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
BI_DA+	1 ^a	Blue		
BI_DA-	2 ^b	White		
a PoDL +				
b PoDL -				

652

653

4.3 Cables**4.3.1 Balanced 1 pair Cables (Type A, B, C)****Table 10: Balanced 1 pair Cable Specification table part 1**

General Requirement:	Application Type A	Application Type B	Application Type C
Design	1 pair Data Cable		
Cable Installation Type	Stationary, no movement after installation	Flexible, occasional movement or vibration	Special applications
Data Element Conductor Cross Section ¹⁾	AWG 22/1 ≥ 0,610 mm	AWG 22/7 ≥ 0,318 mm²	AWG 22/... ≥ 0,318 mm²
Core identification (colour)	Pair 1: white, blue		
Core Diameter IEC 60811-203	1,50 to 1,70 mm		Application specific
Cable Design	2 cores as 1 twisted pair		
Data Element Min. shielding Design	Aluminium Foil + Copper Braiding		Application specific
Outer Cable Diameter IEC 60811-203	5,5 to 6,2 mm ²⁾		
Cable Marking (at least)	“PROFINET Type A 1-Pair”	“PROFINET Type B 1-Pair”	“PROFINET Type C 1-Pair”
Colour (Outer Sheath)	Green RAL6018		Green RAL6018 (preferred)

660

Table 11: Balanced 1 pair Cable Specification table part 2

General Requirement:	Application Type A	Application Type B	Application Type C
Electrical and Transmission Requirement:			
Conductor resistance IEC 60189-1	≤ 62 Ω/km	≤ 60 Ω/km	≤ 62 Ω/km
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-11 ≥ 600 MHz ³⁾	IEC 61156-11 ≥ 600 MHz ³⁾	IEC 61156-12 ≥ T1B
Coupling attenuation IEC 61156-11/12	Type I		
Climatic Requirement:			
Operating temperature	-20°C ...+70°C		
Mechanical Requirement:			
Type of cable	Test-Description	Measurement to be performed	Requirements
Type A, B	Flame retardancy	IEC 60332-1-2	Has to pass the test.
	Crush test of the cable	IEC 62012-1	3000 N
Type C	Application specific		

Note 1) AWG dimensions are given for information only.

Note 2) cabinet cabling with reduced outer diameter and length see Table 111: Requirements of PROFINET

Note 3) Types will be added with the next status of IEC 61156-11

661

The core assignment of the 1-pair cable is indicated by the following colour coding.

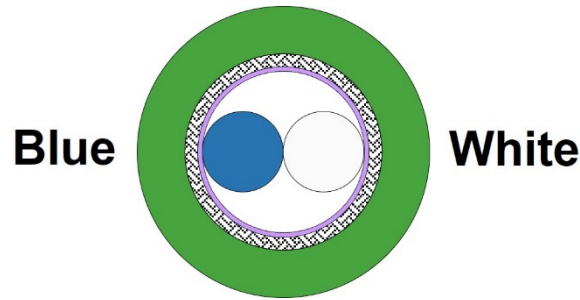


Figure 10: Cable example 1-pair

4.4 Cord Sets

4.4.1 Standard Cord Sets (1pair)

A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system and assembled with a listed cable. PROFINET Standard Cord meets the PROFINET requirements and can be used as part of a component approach.

PROFINET cord sets fulfil the PROFINET component specification and can be used concerning the PROFINET component model.

PROFINET cabling is based on the End-to-End link. The End-to-End link extends the ISO/IEC 11801-3 channel about the plug connectors, which are mated to the PROFINET device (TE/PMD). End-to-End link is specified in IEC 61918.

PROFINET cord set used shall comply with the following parameters:

Table 12: Parameters of cord sets for balanced cabling

Type	PROFINET cord set
Number of wires	2
Cable Type	PROFINET cables
Connector type	GPC, SPC PROFINET connectors
Cord set marking (additional to cable marking)	"PROFINET cord set"

End-to-End link build up with PROFINET cabinet cord sets meet the PROFINET requirements.

4.4.2 Cabinet Cord Set (1pair)

PROFINET Cabinet cord sets are cord sets for cabinet applications. PROFINET Cabinet cord sets fulfil the PROFINET component specification and can be used concerning the PROFINET component model. PROFINET Cabinet cord sets can be realized for field assembly as well as preassembled.

4.4.3 Configuration

Connecting hardware performance is influenced by the properties of the plug termination and therefore cords should be tested to determine the quality of the assembly.

This chapter specifies the minimum requirements for cords. The test methods and mechanical stresses are specified in IEC 61935-2. All requirements of this chapter have to be met after first exposing the device under test to mechanical stress.

Cords shall meet the electrical and mechanical requirements of IEC 61935-2.

The cabinet cord sets shall meet a tightened flexures test in accordance with IEC 61935-2 7.3.

The cabinet cord shall fulfil after the specified flexures at least the category 5 patch cord test according to ISO/IEC 11801-3.

- 696 PROFINET cabinet cord sets shall be labelled as PROFINET cabinet cord sets.
- 697 Cable used to build up a cabinet cord are based electrically on at least category 5 balanced LAN
698 cables according to ISO/IEC 11801-1 Class D.
- 699 The connectors used to build up a cabinet cord shall be in accordance with the specification of the
700 inside connector in chapter 6.
- 701 The Qualification Test for the cabinet cord sets shall meet return loss (RL) and Next requirements
702 specified in ISO/IEC 11801-1 for balanced cords (at least category 5).
- 703
- 704 PROFINET Cabinet cord set used shall comply with the following parameters:
- 705

Table 13: PROFINET Cabinet cord set for 1 pair

General Requirement:	PROFINET Cabinet cord set
Type	1-Pair
Comment	Field harnessed and pre-assembled cord sets are defined
PROFINET Component	Yes
Application	Inside enclosure
Conductor Cross Section ¹⁾	AWG 26 - 22 0,14 - 0,38 mm ²
Conductor design	stranded
Number of cores	2
Core identification (colour)	Pair 1: white, blue
Colour (Outer Sheath)	Green RAL6018
Cabinet cord set marking (at least)	"PROFINET cabinet cord 1-Pair"
Cabinet cord set length	max. 5 m
Electrical and Transmission Requirement:	
Conductor resistance IEC 60189-1	$\leq 148,0 \Omega/\text{km}$
Cable Data Element transmission	IEC 61156-12 $\geq$ T1B
Delay Skew	IEC 61156-12
Cable Coupling attenuation	IEC 61156-12 Type I
Channel performance	IEC 11801-1 T1-B
Connector Coupling	IEC 63171 E3
Climatic Requirement:	
Operating temperature	-20°C ... +70°C
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	Has to pass the test.
Crush test of the cable IEC 62012-1	1000 N

Note 1) AWG dimensions are given for information only.

General Note: Requirements beyond the scope of this guideline shall be agreed upon between the user and the manufacturer.

5 Cabling System 1-pair hybrid

5.1 Scope

Single Pair Ethernet (SPE) hybrid connectivity solutions combine high-speed Ethernet communication, power transmission, and additional signal channels within a single connector and cable infrastructure. Designed for demanding industrial environments, these solutions enable seamless integration of sensors, actuators, controllers, networking devices, and edge systems while reducing cabling complexity and installation effort.

Typical applications include:

- Distributed Control Systems (DCS) and PLC-based automation architectures
- Connection of remote I/O modules, field devices, and intelligent sensors
- SPE communication networks for machine, process, and factory automation
- Simultaneous transmission of Ethernet data, power, and control signals through a single interface
- Integration of SPE with Power over Data Line (PoDL) architectures
- Industrial networking devices such as switches, gateways, routers, and edge computers
- Motion control, robotics, and drive applications requiring combined power and communication channels
- Redundant communication paths for mission-critical automation systems

Available across multiple connector sizes, including M8, M12, M17, M23, and M40, hybrid SPE connectivity solutions support scalable network architectures from compact field devices to high-power industrial equipment. By combining Ethernet communication, power, and auxiliary signals within one robust interface, they simplify system design, reduce installation costs, and accelerate the transition toward Ethernet-based industrial automation.

5.1.1 System landscape

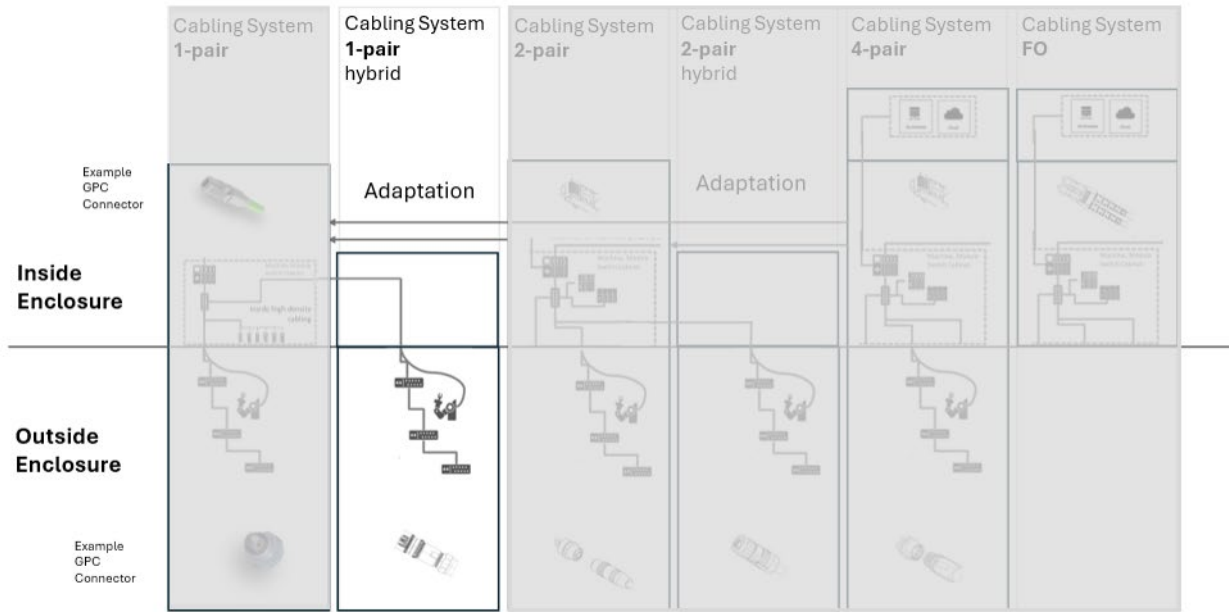


Figure 11: The PROFINET cabling system 1-pair hybrid

M12-Y 2 pair data + 4 x power rugged circular connectors typically used for industrial process measurement and control with M12 connector. Suitable for inside & outside, typical applications are outside environmental with degree of protection IP65/IP67 and data transmission up to 100 Mbit/s.

5.1.2 Physical layer References

IEEE 802.3 10BASE-T ; IEEE 802.3u 100BASE-TX

IEC 61076-2-113

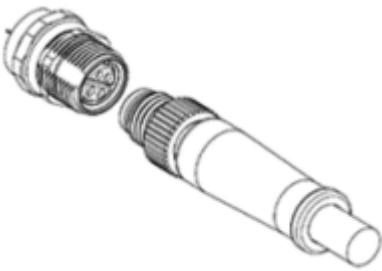
IEC 61156-5 ; IEC 61156-6

5.2 Connectors and cables

These chapter shows assigned 1 pair hybrid connector and cables.

5.2.1 M8 Hybrid SPE connectors according to IEC 63171-6 T1 Industrial Style

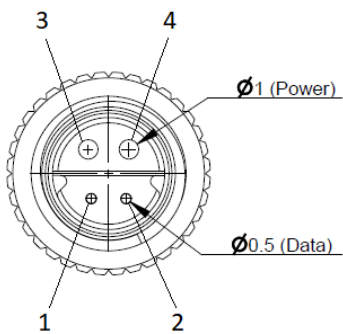
Table 14: SPE connectors according to IEC 63171-6 T1 Industrial Style – Type M8 Hybrid

PROFINET Connector Type:	PROFINET Specific Passive Components (SPC)
Standard:	IEC 63171-6
Figures (technical drawings):	
Product Example (picture):	

Particular Description:

M8 Hybrid SPE 2-way data + 2-way power miniaturized data rugged circular connector typically used in industrial applications to deliver SPE and power to small devices. These connectors consist of fixed and free connectors either rewirable or no-rewirable with M8x1 screw-locking. Suitable for inside & outside, typical applications are outside environmental with degree of protection IP65/IP67 and data transmission up to 600 MHz.

Table 15: Standard requirements of connectors according to IEC 63171-6

Standard/Requirement	Value		
Rated Voltage (IEC 60664-1)	50 V		
Current Rating Power	8 A		
Current Rating Data	1,5 A		
Transmission performance (IEC 63171)	Cat. B		
	Power / Signal	Contact	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	3	U	Red
	4	GND	Black

5.2.1.1 Feasible cables**Table 16: Cable M8 hybrid SPE**

Data Element Conductor Cross SectionA)	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,7 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross SectionA)	n/a
Auxiliary Core Diameter IEC 60811-203	n/a
Power Core Nominal Conductor Cross SectionA)	0,5 – 0,85 mm ² min. IEC 60228 class 5 (AWG 19-18)
Power Core Diameter IEC 60811-203	Max. 1,8 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 7,5 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}b x{no of cores}x{dimension} + {no of cores}x{dimension} ...a... e.g. "PROFINET Hybrid 1x2x0,25qmm + 2x0,75qmm" or "PROFINET Hybrid 1x2xAWG24 + 2xAWG19" a Additional printings are upon agreement between manufacturer and user b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power

Electrical and Transmission Requirement:	
Data Element core	Max. 140 Ω/km
Conductor resistance	
IEC 60189-1	
Data transmission	IEC 61156-6 Cat.5 ^{B)}
ISO/IEC 11801-1	
IEC 61156-1	
Shielding	IEC 61156-6 type I
Auxiliary Core	N/A
Conductor resistance	
IEC 60189-1	
Power Core	Max. 40,1 Ω/km
Conductor resistance	
IEC 60189-1	
Mechanical Requirement:	
Flame retardancy	must pass the test
IEC 60332-1-2	
Operating temperature fixed installation ^a	-20°C ...+70°C
	^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

5.2.2 Cables



Figure 12: Cable example cross section 1-pair hybrid

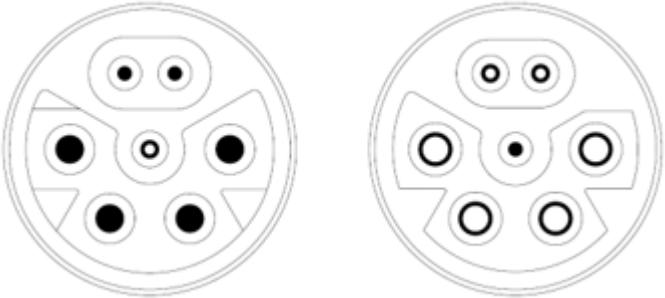
5.2.3 Cable Specification

5.2.3.1 Type A

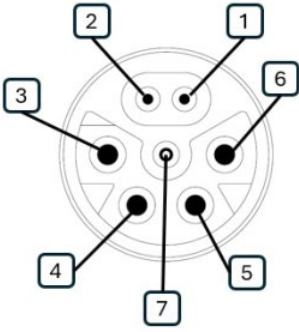
Not Applicable

5.2.4 Connector Type M12-SPE hybrid Type I

Table 17: M12-SPE hybrid Type I

PROFINET Connector Type:	PROFINET Special Passive Components (SPC)
IEC Standard:	IEC 63171-7 Type I
Interface Type (front view):	
Product Example (picture):	

801

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		50 V	
Current Rating Power		2x8 A	
Current Rating Data		2,0 A	
Transmission performance (IEC 63171)		Cat.B	
	Power / Signal	Contact	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	3	Power	
	4	Power	
	5	Power	
	6	Power	
	7	Shield	

802

803 **5.2.5 Feasible Cables**804 **Table 18: M12-SPE hybrid Type I**

Data Element Conductor Cross Section ^{A)}	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	n/a
Auxiliary Core Diameter IEC 60811-203	n/a
Power Core Nominal Conductor Cross Section ^{A)}	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Power Core Diameter IEC 60811-203	Max. 2,3 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 12,0 mm

Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 1x2x0,25qmm + 4x0,75qmm" or "PROFINET Hybrid 1x2xAWG24 + 2xAWG19" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 140 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-12
Data Element Coupling attenuation IEC 61156-12	type I
Auxiliary Core Conductor resistance IEC 60189-1	N/A
Power Core Conductor resistance IEC 60189-1	Max. 40,1 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C ^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

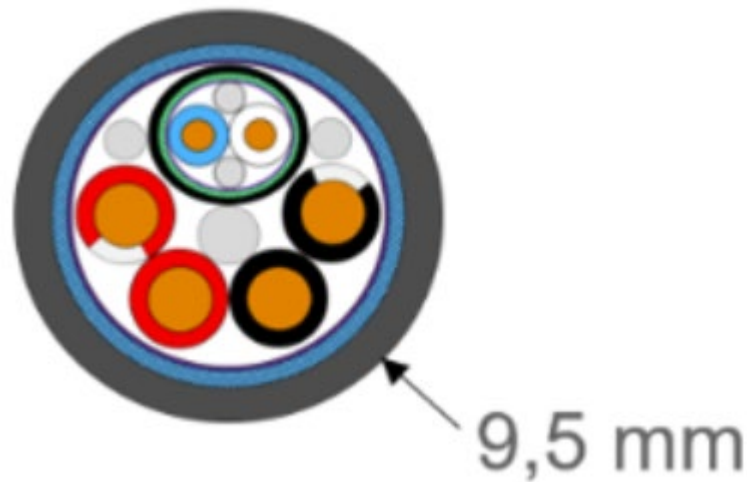


Figure 13: Cable example cross section 1-pair hybrid

5.2.5.1 1 pair hybrid cable specification

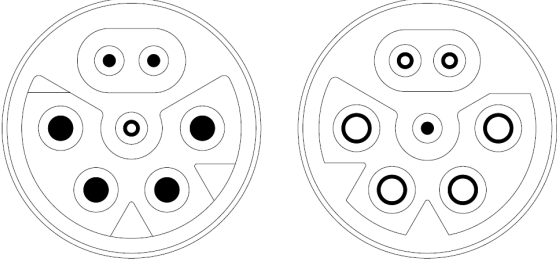
Table 19: 1 pair hybrid cable specification Type C

General Requirement:	Application Type C
Cable Installation Type	Flexible, occasional movement or vibration
Data Element Conductor Cross Section ^{A)}	$\geq 0,318 \text{ mm}^2$ (AWG 22/7)
Data Element Core Diameter IEC 60811-203	1,4 to 1,6 mm
Data Element Min. shielding Design	Aluminium Foil + Copper Braiding
Power Core Conductor Cross Section ^{A)}	$1,5 \text{ mm}^2$ (min. IEC 60228 class 5) (AWG 16)
Power Core Diameter IEC 60811-203	$2,4 \pm 0,2 \text{ mm}$
Outer Cable Diameter IEC 60811-203	8,0 - 12,0 mm
Cable Marking (at least)	"PROFINET Hybrid Type B"
Electrical and Transmission Requirement:	
Data Element Core Conductor resistance IEC 60189-1	$\leq 60 \text{ } \Omega/\text{km}$
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-5 Cat.5e ^{B)}
Power Core Conductor resistance IEC 60189-1	$\leq 14 \text{ } \Omega/\text{km}$ min. IEC 60228 class 5

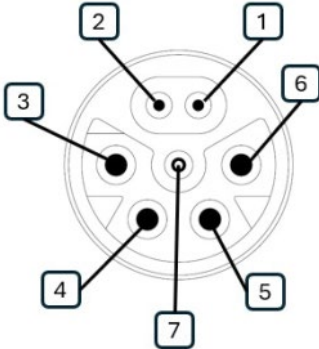
Shielding	IEC 61156-6 type I
Auxiliary Core	IEC 60189-1
Conductor resistance	
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	Has to pass the test.
Crush test of the cable IEC 62012-1	3000 N

5.2.6 Connector Type M12-SPE hybrid Type II

Table 20: M12-SPE hybrid Type II

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
IEC Standard:	IEC 63171-7 Type II
Interface Type (front view):	
Product Example (picture):	

Standard/Requirement	Value
Electrical	
Rated Voltage (IEC 60664-1)	50 V
Current Rating Power	2x8 A
Current Rating Data	2,0 A

Transmission performance (IEC 63171)		Cat.B	
	Power / Signal	Contact	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	3	U1/ L1	BN
	4	GND2/ N2	WH
	5	GND1/ N1	BU
	6	U2/ L2	BK
	7	Shield	

5.2.7 Feasible Cables

Table 21: M12-SPE hybrid Type II

Data Element Conductor Cross Section ^{A)}	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	n/a
Auxiliary Core Diameter IEC 60811-203	n/a
Power Core Nominal Conductor Cross Section ^{A)}	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Power Core Diameter IEC 60811-203	Max. 2,3 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 12,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005

Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 1x2x0,25qmm + 4x0,75qmm" or "PROFINET Hybrid 1x2xAWG24 + 2xAWG19" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 140 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-12
Data Element Coupling attenuation IEC 61156-12	type I
Auxiliary Core Conductor resistance IEC 60189-1	N/A
Power Core Conductor resistance IEC 60189-1	Max. 40,1 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C ^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.



Figure 14: Cable example cross section 1-pair hybrid

5.2.8 1 pair hybrid cable specification

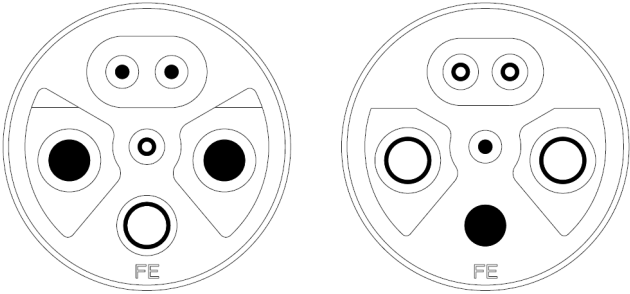
Table 22: 1 pair hybrid cable specification Type C

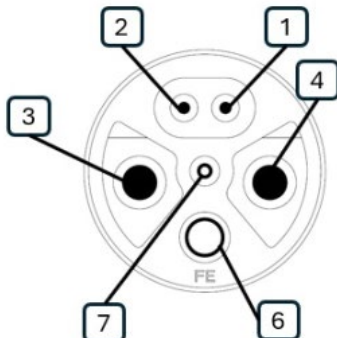
General Requirement:	Application Type C
Cable Installation Type	Flexible, occasional movement or vibration
Data Element Conductor Cross Section ^{A)}	≥ 0,318 mm² (AWG 22/7)
Data Element Core Diameter IEC 60811-203	1,4 to 1,6 mm
Data Element Min. shielding Design	Aluminium Foil + Copper Braiding
Power Core Conductor Cross Section ^{A)}	1,5 mm² (min. IEC 60228 class 5) (AWG 16)
Power Core Diameter IEC 60811-203	2,4 ± 0,2 mm
Outer Cable Diameter IEC 60811-203	8,0 - 12,0 mm
Cable Marking (at least)	“PROFINET Hybrid Type B”
Electrical and Transmission Requirement:	
Data Element Core Conductor resistance IEC 60189-1	≤ 60 Ω/km
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-5 Cat.5e ^{B)}
Power Core Conductor resistance IEC 60189-1	≤ 14 Ω/km min. IEC 60228 class 5

Shielding	IEC 61156-6 type I
Auxiliary Core Conductor resistance	IEC 60189-1
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	Has to pass the test.
Crush test of the cable IEC 62012-1	3000 N

5.2.9 Connector Type M12-SPE hybrid Type VI

Table 23: M12-SPE hybrid Type VI

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
IEC Standard:	IEC 63171-7 Type VI
Interface Type (front view):	
Product Example (picture):	

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		50 V	
Current Rating Power		16 A	
Current Rating Data		2,0 A	
Transmission performance (IEC 63171)		Cat.B	
	Power / Signal	Contact	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	3	U1/ L1	BN
	4	GND1/ N1	BU
	6	FE	PK
	7	Shield	

839

840 **5.2.10 Assigned Cables M12-SPE hybrid Type VI**841 **Table 24: Assigned Cables M12-SPE hybrid Type VI**

Data Element Conductor Cross Section ^{A)}	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	n/a
Auxiliary Core Diameter IEC 60811-203	n/a
Power Core Nominal Conductor Cross Section ^{A)}	0,75 – 2,5 mm ² min. 7 wire (AWG 21-18)
Power Core Diameter IEC 60811-203	Max. 3,2 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 12,5 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005

Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 1x2x0,25qmm + 3x2,5qmm" or "PROFINET Hybrid 1x2xAWG24 + 3xAWG16" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 140 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-12
Data Element Coupling attenuation IEC 61156-12	type I
Auxiliary Core Conductor resistance IEC 60189-1	N/A
Power Core Conductor resistance IEC 60189-1	Max. 40,1 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C ^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

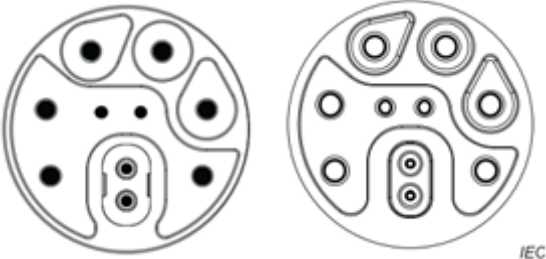
5.2.11 1 pair hybrid cable specification Type C

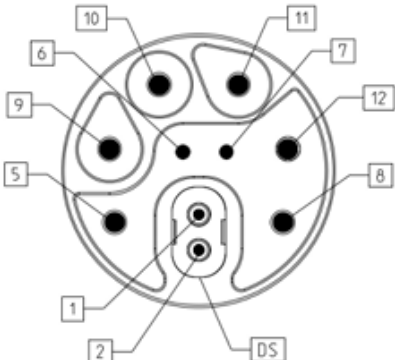
Table 25: 1 pair hybrid cable specification Type C

General Requirement:	Application Type C
Cable Installation Type	Flexible, occasional movement or vibration
Data Element Conductor Cross Section ^{A)}	$\geq 0,318 \text{ mm}^2$ (AWG 22/7)
Data Element Core Diameter IEC 60811-203	1,4 to 1,6 mm
Data Element Min. shielding Design	Aluminium Foil + Copper Braiding
Power Core Conductor Cross Section ^{A)}	$1,5 \text{ mm}^2$ (min. IEC 60228 class 5) (AWG 16)
Power Core Diameter IEC 60811-203	$2,4 \pm 0,2 \text{ mm}$
Outer Cable Diameter IEC 60811-203	8,0 - 12,0 mm
Cable Marking (at least)	"PROFINET Hybrid Type B"
Electrical and Transmission Requirement:	
Data Element Core Conductor resistance IEC 60189-1	$\leq 60 \text{ } \Omega/\text{km}$
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-5 Cat.5e ^{B)}
Power Core Conductor resistance IEC 60189-1	$\leq 14 \text{ } \Omega/\text{km}$ min. IEC 60228 class 5
Shielding	IEC 61156-6 type I
Auxiliary Core Conductor resistance IEC 60189-1	
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	Has to pass the test.
Crush test of the cable IEC 62012-1	3000 N

5.2.12 Connector Type M17 Type 1B coded

Table 26: M17 Type 1B coded

PROFINET Connector Type:	PROFINET General Passive Components (SPC)
IEC Standard:	IEC 61076-2-117 Type 1 B
Interface Type (front view):	
Product picture	

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		600 V	
Current Rating Power		8 A	
Current Auxiliary		6 A	
Current Rating Data		2,0 A	
Transmission performance (ISO/IEC 11801-1)		Cat. B	
	Contact No.	Power / Signal	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	5	Auxiliary	
	6	Auxiliary	
	7	Auxiliary	
	8	Auxiliary	
	9	Power	U1/ L1
	10	Power	GND1/ N1
	11	Power	GND2/ N2
	12	Power	U2/ L2
	DS	Shield	

854 **5.2.13 Assigned Cables M17-SPE hybrid Type 1B**855 **Table 27: Assigned Cables M17-SPE hybrid Type 1B**

Data Element Conductor Cross Section ^{A)}	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	Max.0,75 mm ² min. IEC 60228 class 5 (AWG 19)
Auxiliary Core Diameter IEC 60811-203	Max. 2,3 mm
Power Core Nominal Conductor Cross Section ^{A)}	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Power Core Diameter IEC 60811-203	Max. 2,3 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 12,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 1x2x0,25qmm + 2x0,75qmm + 3x1,00qmm + 2x1,00qmm" or "PROFINET Hybrid 1x2xAWG24 + 2xAWG19 + 5xAWG18" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 140 Ω/km

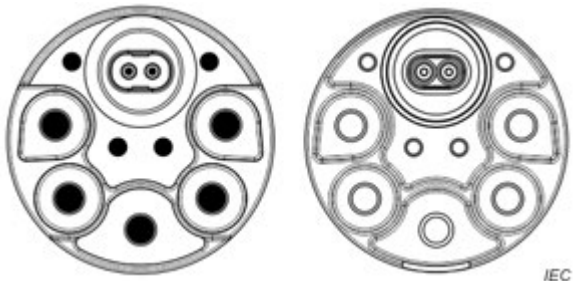
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-12
Data Element Coupling attenuation IEC 61156-12	type I
Auxiliary Core Conductor resistance IEC 60189-1	Max. 26,7 Ω /km
Power Core Conductor resistance IEC 60189-1	Max. 26,7 Ω /km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C ^a Deviation allowed are upon agreement between manufacturer and user

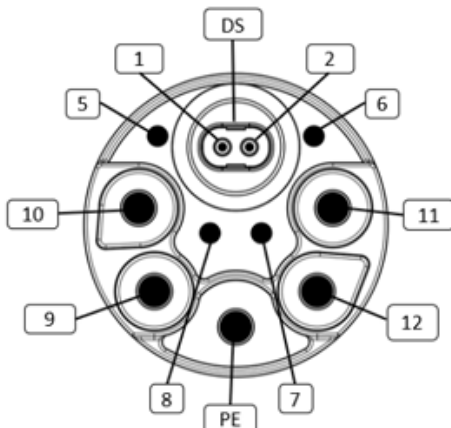
Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

5.2.14 Connector Type M23 Type 1 coded

Table 28: M23 Type 1 coded

PROFINET Connector Type:	PROFINET General Passive Components (SPC)
IEC Standard:	IEC 61076-2-117 M23 Type 1
Interface Type (front view):	
Product picture	

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		600 V	
Current Rating Power		30 A	
Current Rating Auxiliary		6 A	
Current Rating Data		0,5 A	
Transmission performance (ISO/IEC 11801-1)		Cat. B	
	Contact No.	Power / Signal	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	5	Auxiliary	
	6	Auxiliary	
	7	Auxiliary	
	8	Auxiliary	
	9	Power	U1/ L1
	10	Power	GND1/ N1
	11	Power	GND2/ N2
	12	Power	U2/ L2
	PE		
	DS	Shield	

865 **5.2.15 Assigned Cables M23 Type 1**866 **Table 29: Assigned Cables M23 Type 1**

Data Element Conductor Cross Section ^{A)}	min 0,34 mm ² min. 7 wire (AWG 22)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Auxiliary Core Diameter IEC 60811-203	Max. 2,3 mm
Power Core Nominal Conductor Cross Section ^{A)}	4,0 mm ² min. IEC 60228 class 5 (AWG 12)
Power Core Diameter IEC 60811-203	Max. 4,1 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 17,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 1x2x0,34qmm + 4x0,75qmm + 5x4,00qmm" or "PROFINET Hybrid 1x2xAWG22 + 4xAWG19 + 5xAWG12" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 59,4 Ω/km

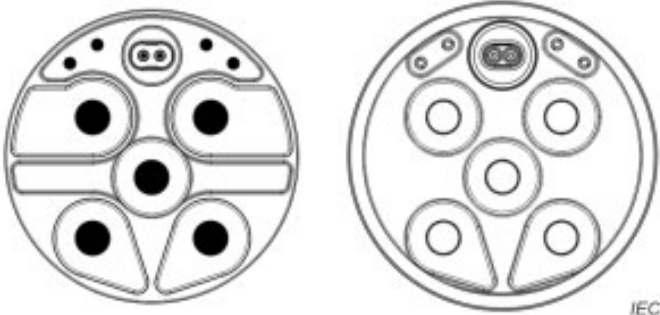
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-12
Data Element Coupling attenuation IEC 61156-12	type I
Auxiliary Core Conductor resistance IEC 60189-1	Max. 26,7 Ω /km
Power Core Conductor resistance IEC 60189-1	Max. 5,1 Ω /km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C ^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.

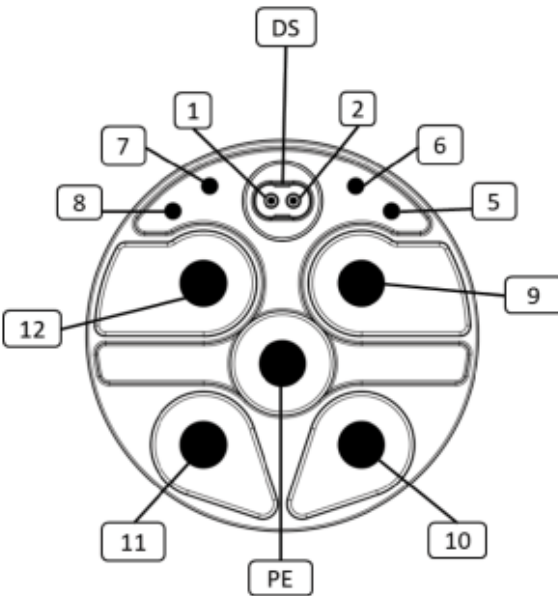
Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

5.2.16 Connector Type M40 Type 1 coded

Table 30: M40 Type 1 coded

PROFINET Connector Type:	PROFINET General Passive Components (SPC)
IEC Standard:	IEC 61076-2-117 M40 Type 1
Interface Type (front view):	
Product picture	

875

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		600 V	
Current Rating Power		70 A	
Current Rating Auxiliary		6 A	
Current Rating Data		0,5 A	
Transmission performance (ISO/IEC 11801-1)		Cat. B	
	Contact No.	Power / Signal	Colour PROFINET
	1	BI_DA+	Blue
	2	BI_DA-	White
	5	Auxiliary	
	6	Auxiliary	
	7	Auxiliary	
	8	Auxiliary	
	9	Power	U1/ L1
	10	Power	GND1/ N1
	11	Power	GND2/ N2
	12	Power	U2/ L2
	PE		YE/GN
	DS	Shield	

876

877 **5.2.17 Assigned Cables M40 Type 1**878 **Table 31: Assigned Cables M40 Type 1**

Data Element Conductor Cross Section ^{A)}	min 0,34 mm ² min. 7 wire (AWG 22)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Auxiliary Core Diameter IEC 60811-203	Max. 2,3 mm
Power Core Nominal Conductor Cross Section ^{A)}	10,0 mm ² min. IEC 60228 class 6 (AWG 8)

Power Core Diameter IEC 60811-203	Max. 8,2 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 25,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 1x2x0,34qmm + 4x0,75qmm + 5x10,00qmm" or "PROFINET Hybrid 1x2xAWG22 + 4xAWG19 + 5xAWG8" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 59,4 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-12
Data Element Coupling attenuation IEC 61156-12	type I
Auxiliary Core Conductor resistance IEC 60189-1	Max. 26,7 Ω/km
Power Core Conductor resistance IEC 60189-1	Max. 1,95 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C
	^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.
 Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

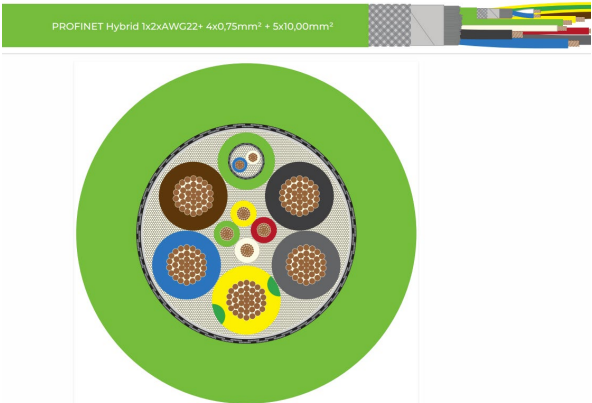


Figure 15: Cable example cross section 1-pair hybrid

5.3 Cord Sets Hybrid

5.3.1 Standard Cord Set Hybrid

A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system and assembled with a listed cable. PROFINET Standard cord sets meet the PROFINET requirements and can be used as part of a component approach.

PROFINET cord set used shall comply with the following parameters:

Table 32: Parameters of standard cord set Hybrid

Type	PROFINET cord set hybrid
Cable Type	PROFINET cables
Connector type	GPC, SPC PROFINET connectors
Cord set marking (additional to cable marking)	"PROFINET cord set"

6 Cabling System 2-pair

6.1 Scope

Industrial 2-pair data cabling based on standard Fast Ethernet technology shall be designed for the transmission of Ethernet data with data rates of 100 Mbit/s. The cables and connectors used shall meet the requirements of industrial automation applications and shall be suitable for installation both in the field and inside control cabinets. The symmetrical 2-pair twisted-pair structure shall ensure reliable signal transmission and shall support the transmission distances specified for Fast Ethernet networks.

6.1.1 System landscape

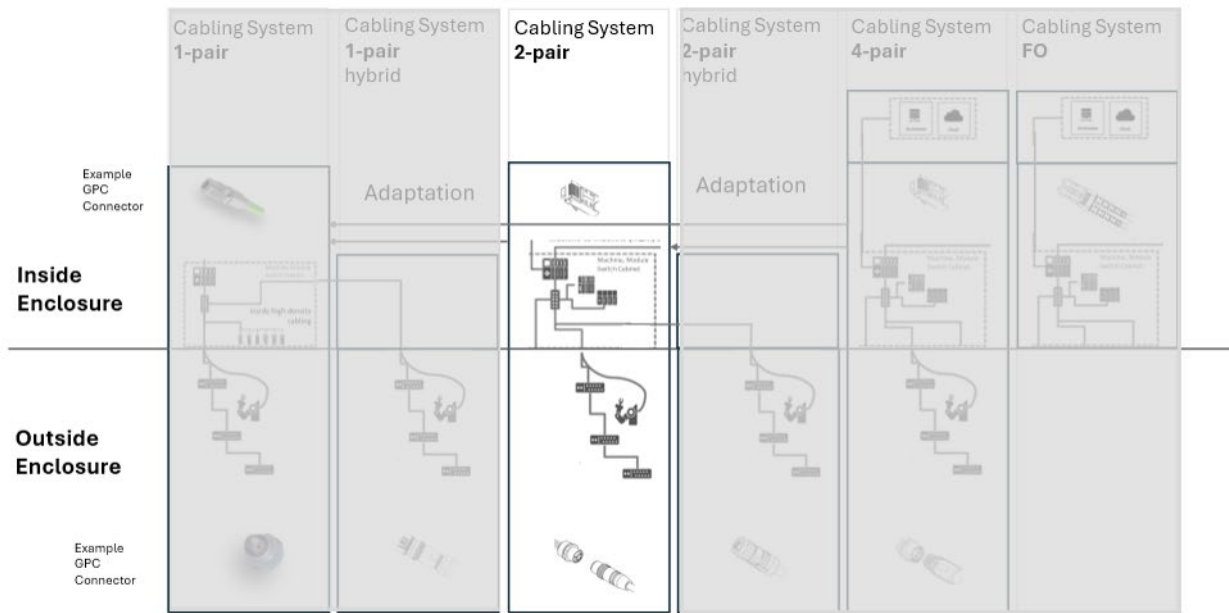


Figure 16: The PROFINET cabling system 2-pair

6.1.2 Description of typical applications

The cabling system shall enable direct connection of field devices, sensors, actuators, and controllers to PROFINET networks. All components of the data cabling system shall comply with relevant industrial requirements regarding electromagnetic compatibility (EMC), mechanical robustness, and safety. The 2-pair Fast Ethernet cabling is intended for use in classic PROFINET automation architectures with standardized performance requirements and long-term availability.

6.1.3 Physical layer References

- IEEE
- IEEE 802.3 (100BASE-TX)
- IEEE 802.3 af (Power over Ethernet PoE)
- IEEE 802.3 at (Power over Ethernet PoE+)
- ISO/IEC
- ISO/IEC 11801-1
- ISO/IEC 11801-3
- ISO/IEC 11801-6

6.2 Connectors

These chapter shows assigned 2 pair connectors.

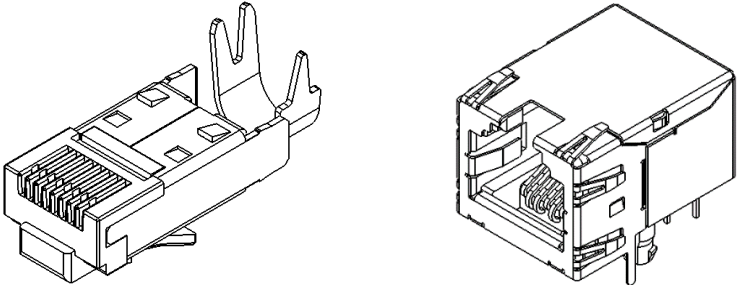
6.2.1 General requirements

The PROFINET General Passive Components (GPC) are designed for PROFINET-defined transmission speeds in point-to-point applications and support different cable diameters optimized for high packing density and long transmission distances. Both field-assembly connectors and pre-manufactured patch cables are fully permitted in PROFINET environments. The system can be used in control cabinets, in-field installations, providing a universal solution. Standardization of the cabling system is ensuring consistent and interoperable mating interfaces across various applications.

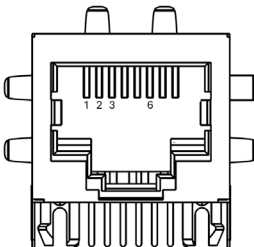
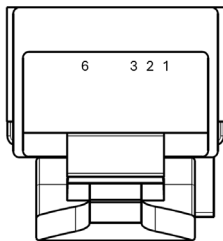
6.2.2 RJ45 2-pair Connector according to IEC 60603-7-3

RJ45 2-pair connectors according to IEC 60603-7-3 are used for PROFINET communication in industrial automation applications. The connectors are available as fixed and free connectors. They are intended for use in protected industrial environments. Typical applications include measurement, control and automation systems using balanced 2-pair Ethernet cabling.

Table 33: RJ45 2 pair Connector according to IEC 60603-7-3

PROFINET Connector Type:	PROFINET General Passive Components (GPC) RJ45 IP20 Connector for Cabinet Connectivity (intern/intern and intern/extern), 2-Pair Balanced Cabling
Standard:	IEC 60603-7-3
Figures (technical drawings):	
Product (picture): Example	

Standard/Requirement	Value
Mechanical	
Mating cycles (mating & unmating)	750 mating cycles
Electrical	
Current Rating	750 mA per contact

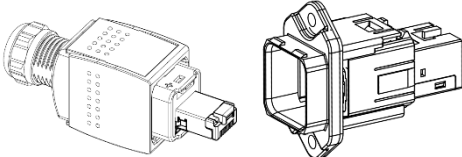
Transmission performance (category)			IEC 60603-7-5 Category 5	
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
TX +	1	YELLOW		
RX +	2	ORANGE		
TX -	3	WHITE		
RX -	6	BLUE		

6.2.3 Connector Type IP6X RJ45 2-pair Push Pull Connector for Balanced Cable

Very robust IP65/67 sealed RJ45 interface to support cabling for PROFINET.

This series represents the standard PROFINET device interface for the IP 65/67 environment. This interface is dedicated for PROFINET connections between switch cabinets and outside machine parts or production equipment.

Table 34: P6X RJ45 2-pair Push Pull Connector for Balanced Cable

PROFINET Connector Type:	PROFINET Specific Passive Components (SPC) RJ45 IP65/67 Connector (Connectors for Outside Environment (Balanced cabling)	
Standard:	IEC 61076-3-117 Variant 14	
Figures (technical drawings):		
Product (picture):	Example	

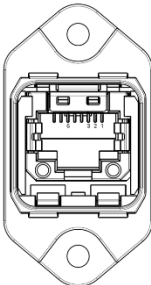
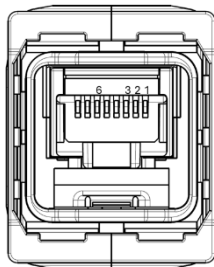
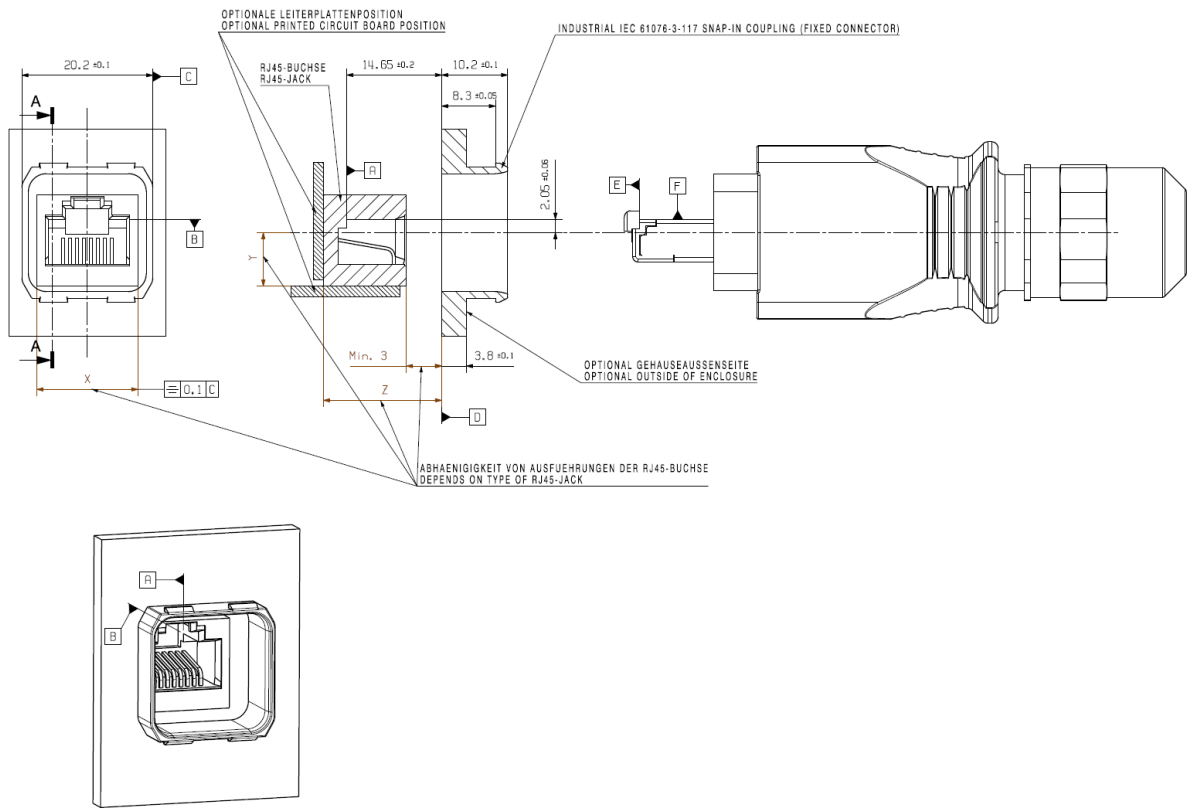
Standard/Requirement			Value	
Mechanical				
Mating cycles (mating & unmating)			750 mating cycles	
Electrical				
Current Rating			750 mA per contact	
Transmission performance (category)			IEC 60603-7-5 Category 5	
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
TX +	1	YELLOW		
RX +	2	ORANGE		
TX -	3	WHITE		
RX -	6	BLUE		

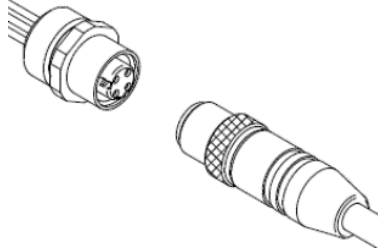
Figure 17: Design Integration Requirements



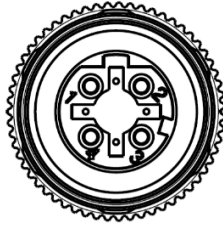
6.2.4 Connector Type IP6X M12-D 2-Pair Connector according to IEC 61076-2-101 D code

M12-D coded 2-pair data rugged circular connectors typically used for industrial process measurement and control. These connectors consist of fixed and free connectors. Suitable for inside & outside, typical applications are outside environmental with degree of protection IP65/IP67.

Table 35: IP6X M12-D 2-Pair Connector according to IEC 61076-2-101 D code

PROFINET Connector Type:	PROFINET General Passive Components (GPC) M12-D coded PROFINET Cat. 5 2 – pair data connector for outside environment
Application Type:	Point to point communication for reliable, high-speed data transmission in industrial automation and harsh-environment applications using M12 connectors.
IEC Standard:	IEC 61076-2-101 M12-D coded
Figures (technical drawings):	
Product Example (picture):	

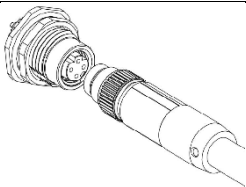
Standard/Requirement	Value
Mechanical	
Mating cycles (mating & unmating)	100 min. acc. IEC 60512 test 9a
Electrical	
Rated current	4 A
Transmission performance	IEC 61076-2-101 Category 5

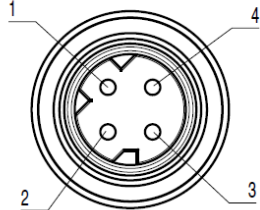
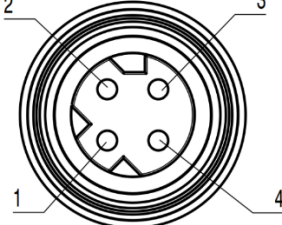
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
TX +	1	YELLOW		
RX +	2	WHITE		
TX -	3	ORANGE		
RX -	4	BLUE		

6.2.5 Connector Type IP6X Connector according to IEC 61076-2-114 M8-D coded

M8-D coded 2-pair data rugged circular connectors typically used for industrial process measurement and control. These connectors consist of fixed and free connectors. Suitable for inside & outside, typical applications are outside environmental with degree of protection IP65/IP67.

Table 36: IP6X Connector according to IEC 61076-2-114 M8-D coded

PROFINET Connector Type:	PROFINET General Passive Components (SPC) M8-D coded PROFINET Cat 5 2 – pair data connector for outside environment
Application Type:	Point to point communication for reliable, high-speed data transmission in industrial automation and harsh-environment applications using M8 connectors.
IEC Standard:	IEC 61076-2-114 M8-D coded
Figures (technical drawings):	
Product Example (picture):	

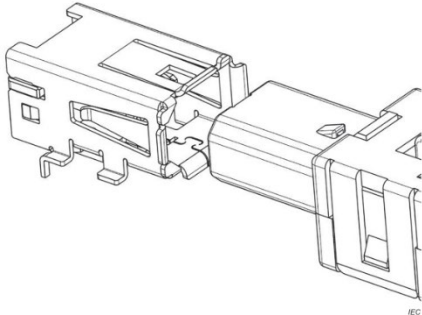
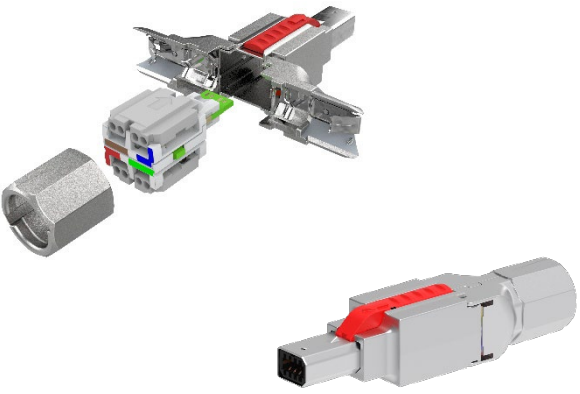
Standard/Requirement			Value	
Mechanical				
Mating cycles (mating & unmating)			100 min. acc. IEC 60512 test 9a	
Electrical				
Rated current			4 A	
Transmission performance			IEC 61076-2-114 Category 5	
Power / Signal	Contact	Colour PROFINET	Fixed connector	Free connector
TX +	1	YELLOW		
RX +	2	WHITE		
TX -	3	ORANGE		
RX -	4	BLUE		

6.2.6 Miniaturized 2-pair Connector according to IEC 61076-3-122 (Mini IO)

Miniaturized PROFINET connectors according to IEC 61076-3 is PROFINET Specific Passive Components (SPC) approved only for special applications. They support balanced 2-pair Ethernet transmission and are not intended as standard PROFINET interfaces.

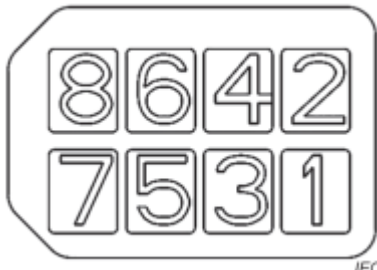
These connectors are particularly suited for miniaturized cabinet connectivity, including internal-to-internal and internal-to-external connections within control cabinets. Their use is restricted to defined PROFINET applications with specific space and integration requirements, where compact connector design is essential.

988 **Table 37: Miniaturized 2-pair Connector according to IEC 61076-3-122 (Mini IO)**

PROFINET Connector Type:	PROFINET Specific Passive Components (SPC) M2M connectivity miniaturized and peripheral cabinet connectivity miniaturized
Standard:	IEC 61076-3-122 Type I
Interface Type (front view):	
Product Example (picture):	

989

990

Standard/Requirement	Value	
Electrical		
Rated Voltage (IEC 60664-1)	50 V	
Current Rating	1 A	
	Cat. 5	
	Contact	Colour PROFINET
	1	Yellow
	2	Orange
	3	White
	4	
	5	
	6	Blue
	7	
	8	

991

992

993

994

995

996

997 **6.1 Cables**

998 These chapter shows assigned 2 pair cables.

999

1000 **6.1.1 Balanced 2 pair Cables (Type A, B, C)**

1001

1002

1003

Table 38: Balanced 2 pair Cable Specification Table part 1

General Requirement:	Application Type A	Application Type B	Application Type C	Application Type R
Design	2 pair Data Cable			
Cable Installation Type	Stationary, no movement after installation	Flexible, occasional movement or vibration	Special applications	Cable for robot applications
Data Element Conductor Cross Section 1)	AWG 22/1 ≥ 0,610 mm	AWG 22/7 ≥ 0,318 mm²	AWG 22/... ≥ 0,318 mm²	
Core identification (colour)	Cable design star quad: white, yellow, blue, orange Cable design 2 twisted pair: Pair 1: white, blue; Pair 2: yellow, orange			
Core Diameter IEC 60811-203	1,40 to 1,60 mm		Application specific	1,40 to 1,60 mm
Cable Design	4 cores as 2 twisted pairs or star quad			
Data Element Min. shielding Design	Aluminium Foil + Copper Braiding		Application specific	screen metal tape coverage 100% and screen of copper wires optical coverage: min. 85% braid or min. 90% spiralized (preferred braided screen)
Outer Cable Diameter IEC 60811-203				5,5 to 8,0 mm 2)
Cable Marking (at least)	“PROFINET Type A 2-Pair”	“PROFINET Type B 2-Pair”	“PROFINET Type C 2-Pair”	“PROFINET Type R 2-Pair”
Colour (Outer Sheath)	Green RAL6018		Green RAL6018 (preferred)	

1004

1005

1006

Table 39: Balanced 2 pair Cable Specification Table part 2

General Requirement:	Application Type A	Application Type B	Application Type C	Application Type R
Electrical and Transmission Requirement:				
Conductor resistance IEC 60189-1	≤ 62 Ω/km	≤ 60 Ω/km	≤ 62 Ω/km	
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-5 (Category 5)	IEC 61156-5 (Category 5)	IEC 61156-6 (Category 5)	
Delay Skew IEC 61156-1	≤ 20 ns/100 m			
Coupling attenuation IEC 61156-5/6	Type I			
Climatic Requirement:				
Operating temperature	-20°C ...+70°C			

1007

1008

1009

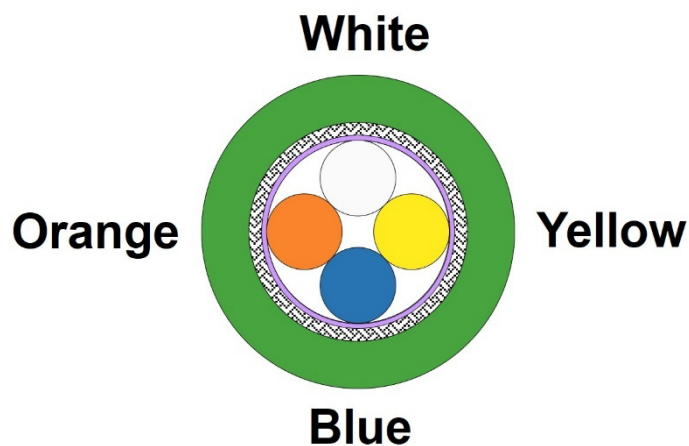
1010 **Table 40: Balanced 2 pair Cable Specification Table part 3**

Mechanical Requirement:			
Type of cable	Test-Description	Measurement to be performed	Requirements
Type A, B	Flame retardancy	IEC 60332-1-2	Has to pass the test.
	Crush test of the cable	IEC 62012-1	3000 N
Type R	Trailing chain test (horizontal)	Bending radius: max. 15xD acceleration: min. 10 speed: min. 180 m/min chain length: min. 5 m cycles: min. 5 million	After 5 million cycles: Pass test of IEC 61156-6 ($\geq$ Category 5) and no crack of jacket
	Torsion test (vertical)	Torsion stress: $\pm 180^\circ/\text{m}$ Cycles: min. 5 million Weight: 300 g EN 50289-3-10	After 5 million cycles: Pass test of IEC 61156-6 ($\geq$ Category 5) and no crack of jacket
	Reverse bending test	Bending radius: max. 7xD Weight: 300 g, cycles: min. 1 million Similar to EN 50396 paragraph 6.4	After 1 million cycles: Pass test of IEC 61156-6 ($\geq$ Category 5) and no crack of jacket
	DC resistance screen	RDC $\leq 14 \text{ m}\Omega/\text{m}$ (measured cable length 30 m) IEC 60189-1	RDC $\leq 14 \text{ m}\Omega/\text{m}$ Screen resistance measure after applying 10A DC (30 s) after mechanical test according to trailing chain or torsion or bending test
Type C	Application specific		

1011 Note 1) AWG dimensions are given for information only.

1012 Note 2) cabinet cabling with reduced outer diameter and length see Table 111: Requirements of PROFINET

1013 The core assignment of the 2-pair cable is indicated by the following colour coding.



1014
1015 **Figure 18: Cable example cross section 2-pair**

1016 6.2 Cord Sets

1017 6.2.1 Standard Cord Set

1018 A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system
1019 and assembled with a listed cable. PROFINET Standard Cord meets the PROFINET requirements
1020 and can be used as part of a component approach.
1021

1022 PROFINET cord sets fulfil the PROFINET component specification and can be used concerning
1023 the PROFINET component model.

1024 PROFINET cabling is based on the End-to-End link. The End-to-End link extends the
1025 ISO/IEC 11801-3 channel about the plug connectors, which are mated to the PROFINET device
1026 (TE/PMD). End-to-End link is specified in IEC 61918.

1027 Cordsets shall be provided with a clear and visible identification indicating that the product is a
1028 cordset. The identification shall be applied by means of a tag, flag, adhesive label, or printed
1029 marking.

1030 Cordsets shall be provided with a clear and visible identification indicating that the product is a
1031 cordset. The identification shall be applied by means of a tag, flag, adhesive label, or printed
1032 marking.

1033 PROFINET cord set used shall comply with the following parameters:

1034 **Table 41: Parameters of cord sets for balanced cabling**

Type	PROFINET cord set
Number of wires	4
Cable Type	PROFINET cables
Connector type	GPC, SPC PROFINET connectors
Cord set marking (additional to cable marking)	"PROFINET cord set"

1035
1036 End-to-End link build up with PROFINET cabinet cord sets meet the PROFINET requirements.

6.2.2 Cabinet cord sets

PROFINET Cabinet cord sets are cord sets for cabinet applications. PROFINET Cabinet cord sets fulfil the PROFINET component specification and can be used concerning the PROFINET component model.

PROFINET Cabinet cord sets can be realized for field assembly as well as preassembled.

6.2.3 Configuration

Connecting hardware performance is influenced by the properties of the plug termination and therefore cords should be tested to determine the quality of the assembly.

This chapter specifies the minimum requirements for cords. The test methods and mechanical stresses are specified in IEC 61935-2. All requirements of this chapter have to be met after first exposing the device under test to mechanical stress.

Cords shall meet the electrical and mechanical requirements of IEC 61935-2.

The cabinet cord sets shall meet a tightened flexures test in accordance with IEC 61935-2 7.3.

The cabinet cord shall fulfil after the specified flexures at least the category 5 patch cord test according to ISO/IEC 11801-3.

PROFINET cabinet cord sets shall be labelled as PROFINET cabinet cord sets.

Cable used to build up a cabinet cord are based electrically on at least category 5 balanced LAN cables according to ISO/IEC 11801-3 Class D.

The connectors used to build up a cabinet cord shall be in accordance with the specification of the inside connector in chapter 6.

The Qualification Test for the cabinet cord sets shall meet return loss (RL) and Next requirements specified in ISO/IEC 11801-3 for balanced cords (at least category 5).

PROFINET Cabinet cord set used shall comply with the following parameters:

Table 42: Requirements of PROFINET cabinet cord sets 2-Pair

General Requirement:	PROFINET Cabinet cord set
Type	2-Pair
Comment	Field harnessed and pre-assembled cord sets are defined
PROFINET Component	Yes
Application	Inside enclosure
Conductor Cross Section ¹⁾	AWG 24 - 22 0,22 - 0,38 mm ²
Conductor design	stranded
Number of cores	4
Core identification (colour)	Cable design star quad: white, yellow, blue, orange Cable design 2 twisted pair: Pair 1: white, blue Pair 2: yellow, orange
Colour (Outer Sheath)	Green RAL6018
Cabinet cord set marking (at least)	"PROFINET cabinet cord 2-Pair"
Cabinet cord set length	max. 5 m
Electrical and Transmission Requirement:	
Conductor resistance IEC 60189-1	≤ 89,3 Ω/km
Cable Data Element transmission	IEC 61156-6 Category 5
Delay Skew	≤ 20ns/100m
Cable Coupling attenuation	IEC 61156-6 Type I
Channel performance	IEC 11801-1 Class D
Connector Coupling	IEC 62153-4-12 max. 45 dB
Climatic Requirement:	
Operating temperature	-20°C ... +70°C
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	Has to pass the test.
Crush test of the cable IEC 62012-1	1000 N

Note 1) AWG dimensions are given for information only.

General Note: Requirements beyond the scope of this guideline shall be agreed upon between the user and the manufacturer.

7 Cabling System 2-pair hybrid

7.1 Scope

Industrial hybrid connectivity solutions combine high-speed 2-Pair Ethernet communication, power transmission, and additional signal channels within a single connector and cable infrastructure. Designed for demanding industrial environments, these solutions enable seamless integration of sensors, actuators, controllers, networking devices, and edge systems while reducing cabling complexity and installation effort.

Typical applications include:

- Distributed Control Systems (DCS) and PLC-based automation architectures
- Connection of remote I/O modules, field devices, and intelligent sensors
- 2-Pair Ethernet communication networks for machine, process, and factory automation
- Simultaneous transmission of Ethernet data, power, and control signals through a single interface
- Industrial networking devices such as switches, gateways, routers, and edge computers
- Motion control, robotics, and drive applications requiring combined power and communication channels
- Redundant communication paths for mission-critical automation systems
- Machine building, transportation, energy, and process automation applications

Available across multiple connector sizes, including M8, M12, M17, M23, and M40, hybrid Ethernet connectivity solutions support scalable network architectures from compact field devices to high-performance industrial equipment. By combining Ethernet communication, power, and auxiliary signals within one robust interface, they simplify system design, reduce installation costs, and support the increasing convergence of IT and OT networks in modern industrial environments.

7.1.1 System landscape

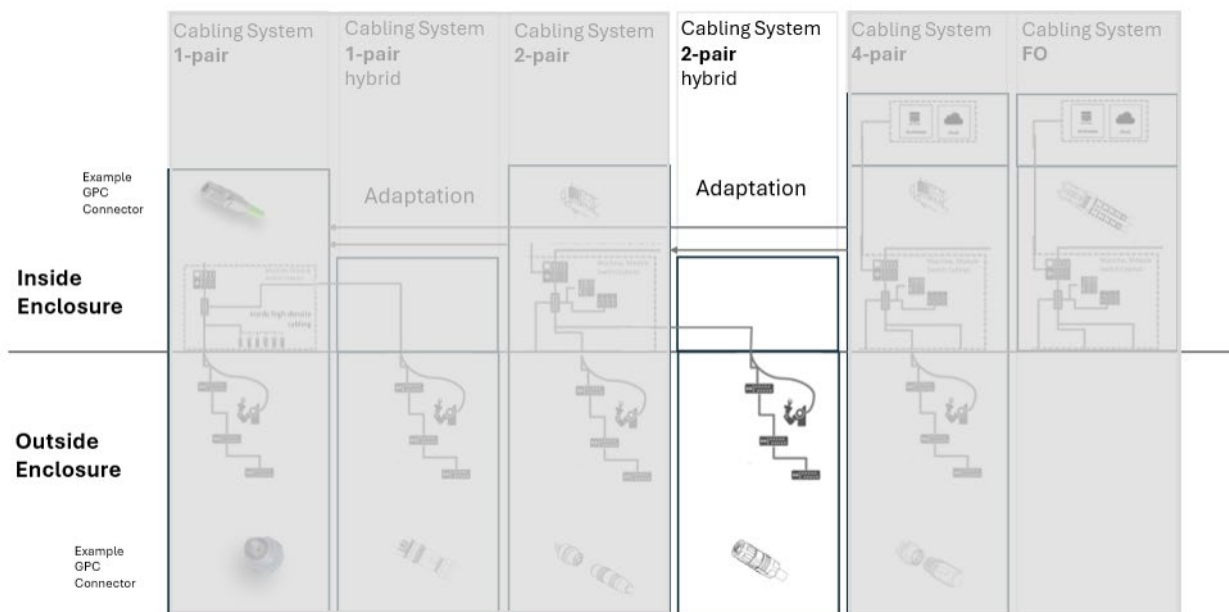


Figure 19: The PROFINET cabling system 2-pair hybrid

M12-Y 2 pair data + 4 x power rugged circular connectors typically used for industrial process measurement and control with M12 connector. Suitable for inside & outside, typical applications are outside environmental with degree of protection IP65/IP67 and data transmission up to 100 Mbit/s.

7.1.2 Physical layer References

IEEE 802.3 10BASE-T ; IEEE 802.3u 100BASE-TX

IEC 61076-2-113

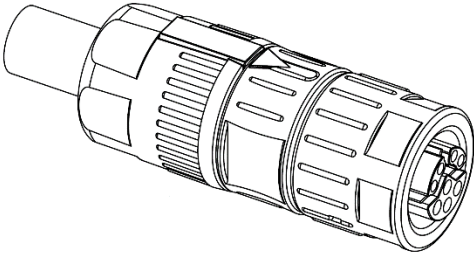
IEC 61156-5 ; IEC 61156-6

7.2 Connectors and cables

These chapter shows assigned 2 pair connectors and cables.

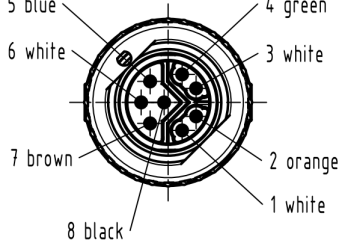
7.2.1 Connector Type M12-Y coded Specification

Table 43: PROFINET Cabinet cord set specification

PROFINET Connector Type:	PROFINET General Passive Components (SPC)
IEC Standard:	IEC 61076-2-113 Type 4
Figures (technical drawings):	
Product Example (picture):	

7.2.2 Technical Requirements Connector

Table 44: Connector Type M12-Y Type 4 coded Specification

Standard/Requirement		Value		
Electrical				
Rated Voltage (IEC 60664-1)		50 V		
Operating Voltage Systemlevel		≤63V DC		
Current Rating Power		6 A		
Current Rating Data		0,5 A		
Transmission performance (ISO/IEC 11801-1)		Cat. 5		
	Power / Signal	Contact	Colour PROFINET	Alternative ANSI/ TIA
	TX +	1	YELLOW	WHITE/ORANGE
	TX -	2	ORANGE	ORANGE
	RX +	3	WHITE	WHITE/GREEN
	RX -	4	BLUE	GREEN
	N1	5	BLUE	N.A.
	N2	6	WHITE	N.A.
	L1	7	BROWN	N.A.
	L2	8	BLACK	N.A.

1116 7.2.3 Assigned cables M12-Y Type 4

1117 Table 45: Assigned cables M12-Y Type 4

Data Element Conductor Cross Section ^{A)}	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: ANSI / TIA
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross Section ^{A)}	n/a
Auxiliary Core Diameter IEC 60811-203	n/a
Power Core Nominal Conductor Cross Section ^{A)}	0,5 – 0,85 mm ² min. 7 wire (AWG 21-18)
Power Core Diameter IEC 60811-203	Max. 1,8 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 9,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}^b x{no of cores}x{dimension} + {no of cores}x{dimension} ...^a... e.g. "PROFINET Hybrid 2x2x0,25qmm + 4x0,75qmm" or "PROFINET Hybrid 1x4xAWG26 + 4xAWG18" ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power

Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 140 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-6 Cat.5 ^{B)}
Shielding	IEC 61156-6 type I
Auxiliary Core Conductor resistance IEC 60189-1	N/A
Power Core Conductor resistance IEC 60189-1	Max. 40,1 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation ^a	-20°C ...+70°C ^a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.
Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.



Figure 20: Cable example cross section 2-pair hybrid

7.2.4 Hybrid cabling Type C

Table 46: Hybrid cabling Type C

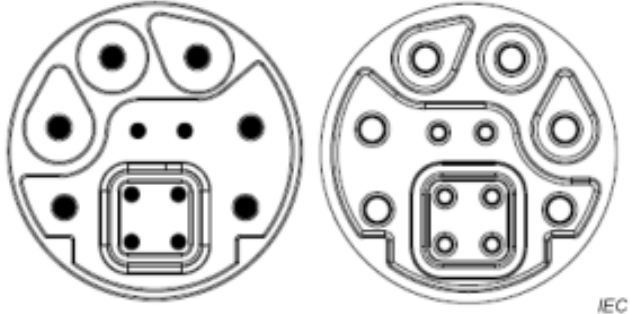
Cable Installation Type	Special Applications (e.g. highly flexible, permanent movement, vibration or torsion)
Data Element Conductor Cross Section ^{A)}	$\geq 0,318 \text{ mm}^2$ (AWG 22/...)
Data Element Core Diameter IEC 60811-203	Application specific
Data Element Core identification	<u>Star quad</u> : white, blue, yellow, orange or <u>2 twisted pairs</u> : Pair 1: white, blue Pair 2: yellow orange
Data Element Min. shielding Design	Application specific
Power Core Conductor Cross Section ^{A)}	$1,5 \text{ mm}^2$ (min. IEC 60228 class 5) (AWG 16)
Power Core Diameter IEC 60811-203	Application specific
Power Core Core identification	Black with numbers 1,2, ..., n or colours: brown, white, blue, black
Outer Cable Diameter IEC 60811-203	8,0 - 12,0 mm
Colour outer sheath	Application specific
Cable Marking (at least)	"PROFINET Hybrid Type C"
Electrical and Transmission Requirement:	
Data Element Core Conductor resistance IEC 60189-1	$\leq 62 \text{ } \Omega/\text{km}$
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-6 Cat.5 ^{B)}
Data element Delay skew IEC 61156	$\leq 20 \text{ ns}/100 \text{ m}$
Data Element Coupling attenuation EN 50289-1-6	$\geq 80 \text{ dB}$ at 30 MHz to 100 MHz
Power Core Conductor resistance IEC 60189-1	$\leq 14 \text{ } \Omega/\text{km}$
Power Core Maximal current in each power wire:	For $T \leq 55^\circ\text{C}$: 16 A For $T > 55^\circ\text{C}$ the current is not specified but may be indicated in the relevant detailed specification of the cable manufacturer (derating diagram)
Mechanical Requirement:	
Operating temperature	$-20^\circ\text{C} \dots +70^\circ\text{C}$

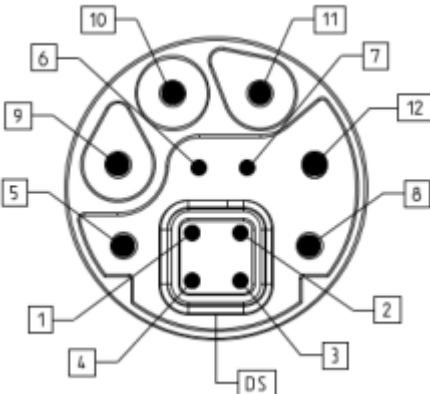
Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

7.2.5 Connector Type M17 Type 2 B coded

Table 47: M17 Type 2 B coded

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
IEC Standard:	IEC 61076-2-117 Type 2 B
Interface Type (front view):	
Product Example (picture):	

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		50 V	
Current Rating Power		8 A	
Current Auxiliary		6 A	
Current Rating Data		0,5 A	
Transmission performance (ISO/IEC 11801-1)		Cat.5	
	Contact No.	Power / Signal	Colour PROFINET
	1	TX +	YELLOW
	2	RX +	WHITE
	3	TX -	ORANGE
	4	RX -	BLUE
	5	Auxiliary	
	6	Auxiliary	
	7	Auxiliary	
	8	Auxiliary	
	9	Power	U1/ L1
	10	Power	GND1/ N1
	11	Power	GND2/ N2
	12	Power	U2/ L2
	DS	Shield	

1138

1139 **7.2.6 Assigned Cables M17 Type 2 B**1140 **Table 48: Assigned Cables M17 Type 2 B**

Data Element Conductor Cross SectionA)	0,14 – 0,25 mm ² min. 7 wire (AWG 26-24)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: white, yellow, blue, orange
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross SectionA)	Max.0,75 mm ² min. IEC 60228 class 5 (AWG 19)
Auxiliary Core Diameter IEC 60811-203	Max. 2,3 mm
Power Core Nominal Conductor Cross SectionA)	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Power Core Diameter IEC 60811-203	Max. 2,3 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 12,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}b x{no of cores}x{dimension} + {no of cores}x{dimension} ...a... e.g. "PROFINET Hybrid 2x2x0,25qmm + 2x0,75qmm + 3x1,00qmm + 2x1,00qmm" or "PROFINET Hybrid 1x4xAWG24 + 2xAWG19 + 5xAWG18" a Additional printings are upon agreement between manufacturer and user b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power

1141

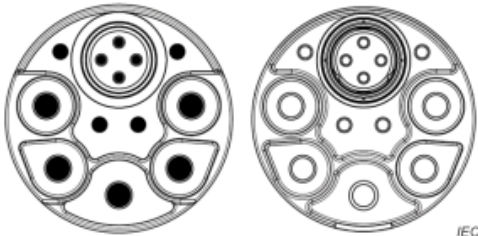
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 140 Ω /km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-6 Cat.5 B)
Shielding	IEC 61156-6 type I
Auxiliary Core Conductor resistance IEC 60189-1	Max. 26,7 Ω /km
Power Core Conductor resistance IEC 60189-1	Max. 26,7 Ω /km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installations	-20°C ...+70°C a Deviation allowed are upon agreement between manufacturer and user

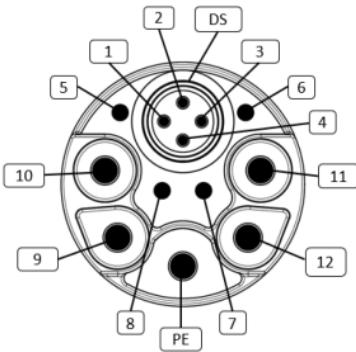
Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the connected devices. Screening values depending on the application.

7.2.7 Connector Type M23 Type 2 coded

Table 49: M23 Type 2 coded

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
IEC Standard:	IEC 61076-2-117 M23 Type 2
Interface Type (front view):	
Product Example (picture):	

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		600 V	
Current Rating Power		30 A	
Current Rating Auxiliary		6 A	
Current Rating Data		0,5 A	
Transmission performance (ISO/IEC 11801-1)		Cat. B	
	Contact No.	Power / Signal	Colour PROFINET
	1	TX +	YELLOW
	2	RX +	WHITE
	3	TX -	ORANGE
	4	RX -	BLUE
	5	Auxiliary	
	6	Auxiliary	
	7	Auxiliary	
	8	Auxiliary	
	9	Power	L1
	10	Power	N1
	11	Power	L2
	12	Power	N2
	PE		
	DS	Shield	

1151

1152 **7.2.8 Assigned Cables M23 Type 2**1153 **Table 50: Assigned Cables M23 Type 2**

Data Element Conductor Cross SectionA)	min 0,34 mm ² min. 7 wire (AWG 22)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: white, yellow, blue, orange
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross SectionA)	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Auxiliary Core Diameter IEC 60811-203	Max. 2,3 mm
Power Core Nominal Conductor Cross SectionA)	4,0 mm ² min. IEC 60228 class 5 (AWG 12)

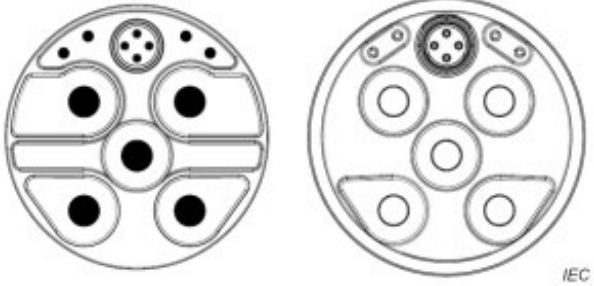
Power Core Diameter IEC 60811-203	Max. 4,1 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 17,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}b x{no of cores}x{dimension} + {no of cores}x{dimension} ...a... e.g. "PROFINET Hybrid 2x2x0,34qmm + 4x0,75qmm + 5x4,00qmm" or "PROFINET Hybrid 1x4xAWG22 + 4xAWG19 + 5xAWG12" a Additional printings are upon agreement between manufacturer and user b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 59,4 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-6 Cat.5 B)
Shielding	IEC 61156-6 type I
Auxiliary Core Conductor resistance IEC 60189-1	Max. 26,7 Ω/km
Power Core Conductor resistance IEC 60189-1	Max. 5,1 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installationa	-20°C ...+70°C a Deviation allowed are upon agreement between manufacturer and user

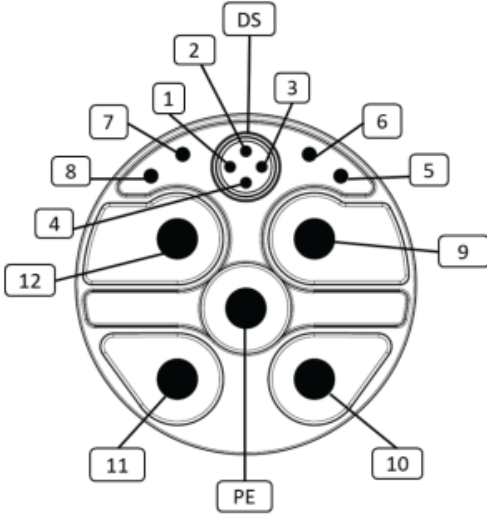
Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the
connected devices. Screening values depending on the application.

7.2.9 Connector Type M40 Type 2 coded

Table 51: M40 Type 2 coded

PROFINET Connector Type:	PROFINET General Passive Components (GPC)
IEC Standard:	IEC 61076-2-117 M40 Type 2
Interface Type (front view):	
Product Example (picture):	

Standard/Requirement		Value	
Electrical			
Rated Voltage (IEC 60664-1)		600 V	
Current Rating Power		70 A	
Current Rating Auxiliary		6 A	
Current Rating Data		0,5 A	
Transmission performance (ISO/IEC 11801-1)		Cat. B	
	Contact No.	Power / Signal	Colour PROFINET
	1	TX +	YELLOW
	2	RX +	WHITE
	3	TX -	ORANGE
	4	RX -	BLUE
	5	Auxiliary	
	6	Auxiliary	
	7	Auxiliary	
	8	Auxiliary	
	9	Power	L1
	10	Power	N1
	11	Power	L2
	12	Power	N2
	PE		
	DS	Shield	

1163

1164

1165 **7.2.10 Assigned Cables M40 Type 2**1166 **Table 52: Assigned Cables M40 Type 2**

Data Element Conductor Cross SectionA)	min 0,34 mm ² min. 7 wire (AWG 22)
Data Element Core Diameter (IEC 60811-203)	Max. 1,6 mm
Data Element Core identification	PROFINET: yellow, orange, white, blue Alternative: allowed
Data Element Min. Shielding Design	Aluminium Foil + Copper Braiding
Auxiliary Core Nominal Conductor Cross SectionA)	0,75 – 1,00 mm ² min. IEC 60228 class 5 (AWG 19-18)
Auxiliary Core Diameter IEC 60811-203	Max. 2,3 mm

Power Core Nominal Conductor Cross SectionA)	10,0 mm ² min. IEC 60228 class 6 (AWG 8)
Power Core Diameter IEC 60811-203	Max. 8,2 mm
Non Data Core Identification	Unambiguously identification per core mandatory via colour and/or numbering
Outer Cable Diameter IEC 60811-203	Max. 25,0 mm
Colour outer sheath	PROFINET: green RAL 6018 Alternative: allowed e.g. black RAL 9005
Cable Marking	Mandatory: PROFINET HYBRID {no. of pairs}b x{no of cores}x{dimension} + {no of cores}x{dimension} ...a... e.g. "PROFINET Hybrid 2x2x0,34qmm + 4x0,75qmm + 5x10,00qmm" or "PROFINET Hybrid 1x4xAWG22 + 4xAWG19 + 5xAWG8" a Additional printings are upon agreement between manufacturer and user b Text between { } defines content to be selected { } are not to be printed on the cable. Order: First data, then power
Electrical and Transmission Requirement:	
Data Element core Conductor resistance IEC 60189-1	Max. 59,4 Ω/km
Data transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-6 Cat.5 B)
Shielding	IEC 61156-6 type I
Auxiliary Core Conductor resistance IEC 60189-1	Max. 26,7 Ω/km
Power Core Conductor resistance IEC 60189-1	Max. 1,95 Ω/km
Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	must pass the test
Operating temperature fixed installation	-20°C ...+70°C a Deviation allowed are upon agreement between manufacturer and user

Note A: AWG dimensions are given for information only.

Note B: The possible channel length of the hybrid cable depends on the power consumption of the
connected devices. Screening values depending on the application.



Figure 21: Cable example cross section 2-pair hybrid

7.3 Cord Sets Hybrid

7.3.1 Standard Cord Set Hybrid

A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system and assembled with a listed cable. PROFINET Standard Cord meets the PROFINET requirements and can be used as part of a component approach.

PROFINET cord sets fulfil the PROFINET component specification and can be used concerning the PROFINET component model.

Cordsets shall be provided with a clear and visible identification indicating that the product is a cordset. The identification shall be applied by means of a tag, flag, adhesive label, or printed marking.

PROFINET cord set used shall comply with the following parameters:

Table 53: Parameters of standard cord set Hybrid

Type	PROFINET cord set hybrid
Cable Type	PROFINET cables
Connector type	GPC, SPC PROFINET connectors
Cord set marking (additional to cable marking)	"PROFINET cord set"

8 Cabling System 4-pair

8.1 Scope

Industrial 4-pair balanced data cabling, compliant with ISO/IEC 11801-3 (Class EA / Category 6A and higher), shall support Ethernet data transmission rates up to 10 Gbit/s. The symmetrical 4-pair twisted-pair structure shall ensure reliable signal transmission over the channel lengths specified for Gigabit and 10-Gigabit Ethernet. The cabling system shall be suitable for industrial use in the field and in control cabinets and shall provide a standardized physical layer for high-performance PROFINET communication.

The PROFINET General Passive Components (GPC) are designed for PROFINET-defined transmission speeds in point-to-point applications and support different cable diameters optimized for high packing density and long transmission distances. Both field-assembly connectors and pre-manufactured patch cables are fully permitted in PROFINET environments. The system can be used in control cabinets and in field installations. Standardization of the cabling system is ensuring consistent and interoperable mating interfaces across various applications.

8.1.1 System landscape

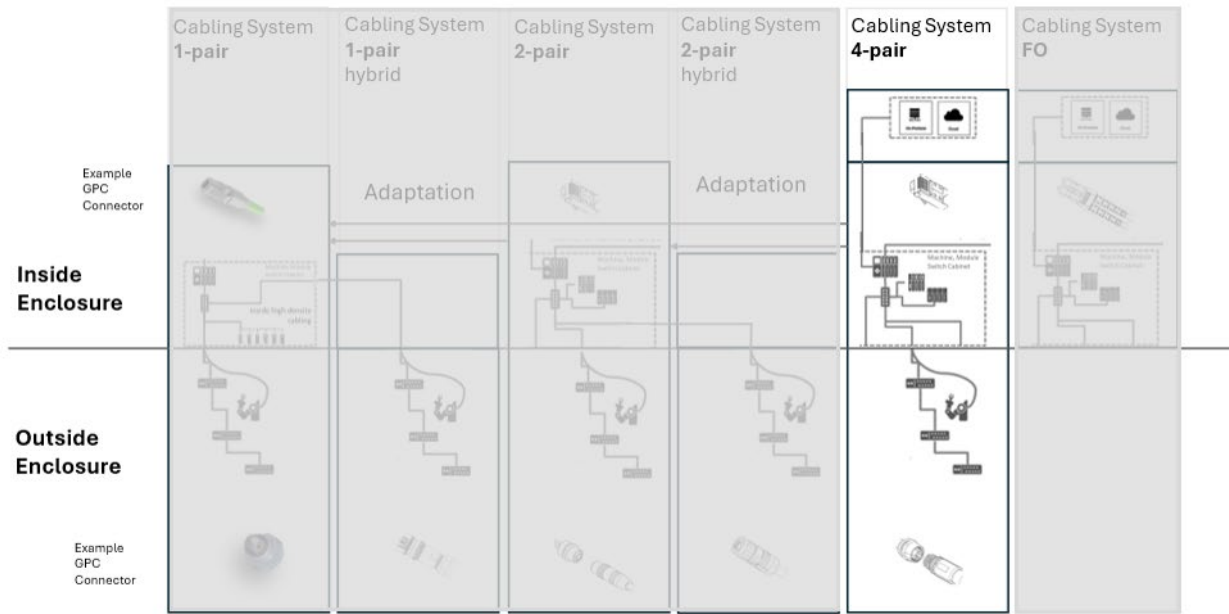


Figure 22: The PROFINET cabling system 4-pair

8.1.2 Description of typical applications

The cabling system shall enable direct connection of field devices and controllers to PROFINET networks operating with up to 10-Gigabit Ethernet physical layers. All components of the data cabling system shall comply with relevant industrial requirements regarding electromagnetic compatibility (EMC), mechanical robustness, and safety. The 4-pair high-performance Ethernet cabling is intended for use in high-bandwidth PROFINET automation architectures requiring standardized performance, scalability, and long-term availability.

8.1.3 Physical layer References

- IEEE
- IEEE 802.3 (1000BASE-T)
- IEEE 802.3 af (Power over Ethernet PoE)
- IEEE 802.3 at (Power over Ethernet PoE+)
- ISO/IEC
- ISO/IEC 11801-1
- ISO/IEC 11801-3
- ISO/IEC 11801-6

8.2 Connectors

These chapter shows assigned 2 pair connectors.

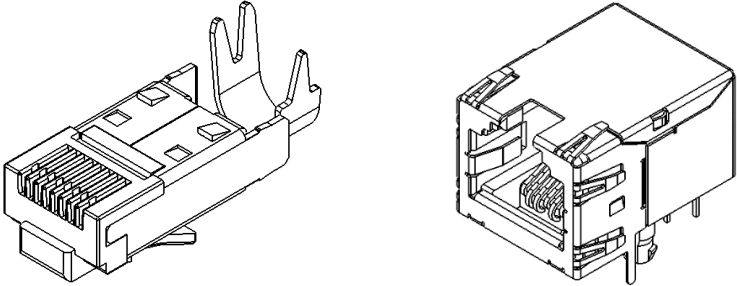
8.2.1 IP 6x 4 Pair Connector for Balanced Cable

Connectors according to IEC 61076-2-109 (M12 X-coded) are 8-way (4-pair) rugged circular connectors for balanced data transmission with frequencies of up to 500 MHz, intended for industrial Ethernet applications such as process measurement and data acquisition. The M12-X coded connector system includes fixed and free, field-attachable or cordset versions. The connectors shall be suitable for indoor and outdoor use and shall provide a degree of protection of at least IP65/IP67 for operation in harsh industrial environments.

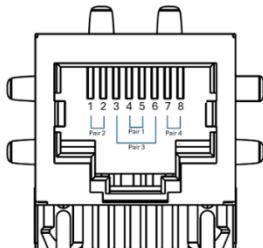
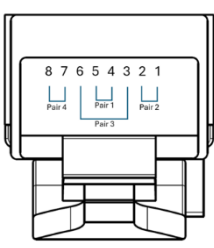
8.2.2 RJ45 4-pair connectors according to IEC 60603-7 series

RJ45 4-pair connectors according to IEC 60603-7 series are used for PROFINET communication in industrial automation applications and shall be considered the standard interface for PROFINET cabling in protected indoor environments. The connectors support balanced 4-pair Ethernet transmission and are available as fixed and free connectors, either field-attachable or pre-assembled. The achievable degree of protection depends on the connector design and installation. Typical applications include measurement, control, and automation systems using balanced 4-pair Ethernet cabling for data rates up to 10 Gigabit.

Table 54: RJ45 4 pair connectors according to IEC 60603 7

PROFINET Connector Type:	PROFINET General Passive Components (GPC) RJ45 IP20 Connector for Cabinet Connectivity (intern/intern and intern/extern), 4-Pair Balanced Cabling
Standard:	IEC 60603-7-3
Figures (technical drawings):	
Product Example (picture):	

1244

Standard/Requirement				Value	
Mechanical					
Mating cycles (mating & unmating)				750 mating cycles	
Electrical					
Current Rating				750 mA per contact	
Transmission performance (category)				IEC 60603-7-51 Cat. 6A	
Power / Signal	IEEE 802.3 Signal	PROFINET Colour-code	PROFINET	Fixed connector	Free connector
	Gigabit Ethernet MDI		Pair		
1	BI_DB+	White/ Orange	Pair 2		
2	BI_DB-	Orange			
3	BI_DA+	White/ Green	Pair 3		
4	BI_DD+	Blue	Pair 1		
5	BI_DD-	White/ Blue			
6	BI_DA-	Green	Pair3		
7	BI_DC+	White/ Brown	Pair 4		
8	BI_DC-	Brown			

1245
1246
1247

8.2.3 RJ45 4-pair Push Pull Connector for Balanced Cable

1249 Very robust IP65/67 sealed RJ45 interface to support cabling for PROFINET.

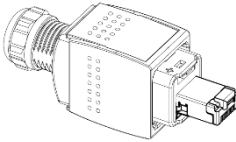
1250 This series represents the standard PROFINET device interface for the IP 65/67 environment. This
1251 interface is dedicated for PROFINET connections between switch cabinets and outside machine
1252 parts or production equipment.

1253

1254

1255

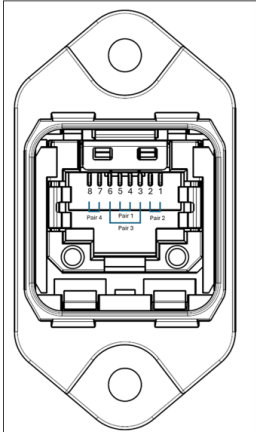
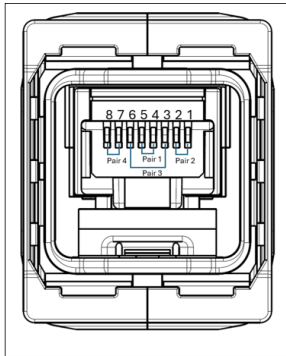
Table 55: RJ45 4-pair Push Pull Connector for Balanced Cable

PROFINET Connector Type:	PROFINET Specific Passive Components (SPC) RJ45 IP65/67 Connector (Connectors for Outside Environment (Balanced cabling)
Standard:	IEC 61076-3-117 Variant 14
Figures (technical drawings):	
Product Example (picture):	

8.2.4 RJ45 4-pair connectors according to IEC 60603-7-1

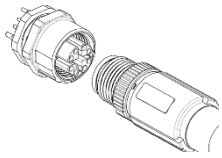
RJ45 4-pair connectors according to IEC 60603-7 are used for PROFINET communication in industrial automation applications and shall be considered the standard interface for PROFINET cabling in protected indoor environments. The connectors shall support balanced 4-pair Ethernet transmission and are available as fixed and free connectors, either field-attachable (rewireable) or non-rewireable. The achievable degree of protection depends on the connector design and installation. Typical applications include measurement, control, and automation systems using balanced 4-pair Ethernet cabling for Gigabit and higher data rates.

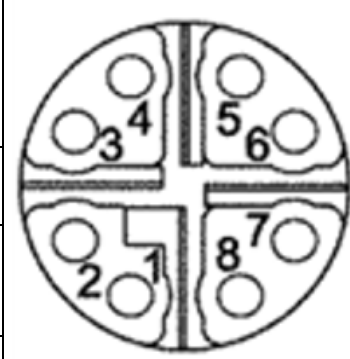
Table 56: J45 4 pair connectors according to IEC 60603 7-1

Standard/Requirement				Value	
Mechanical					
Mating cycles (mating & unmating)				750 mating cycles	
Electrical					
Current Rating				750 mA per contact	
Transmission performance (category)				IEC 60603-7-51 Cat. 6A	
Power / Signal	IEEE 802.3 Signal Gigabit Ethernet MDI	PROFINET Colour-code	PROFINET	Fixed connector	Free connector
			Pair		
1	BI_DB+	White/ Orange	Pair 2		
2	BI_DB-	Orange			
3	BI_DA+	White/ Green	Pair 3		
4	BI_DD+	Blue	Pair 1		
5	BI_DD-	White/ Blue			
6	BI_DA-	Green	Pair3		
7	BI_DC+	White/ Brown	Pair 4		
8	BI_DC-	Brown			

8.2.5 M12-X-coded 4-pair Connector according to IEC 61076-2-109 M12-X coded

Table 57: M12-X-coded 4-pair Connector according to IEC 61076-2-109 M12-X coded

PROFINET Connector Type:	PROFINET General Passive Component (GPC) M12-X coded PROFINET Cat 6 _A 4-pair data connector for outside environment
Standard:	IEC 61076-2-109 M12-X coded
Figures (technical drawings):	
Product Example (picture):	

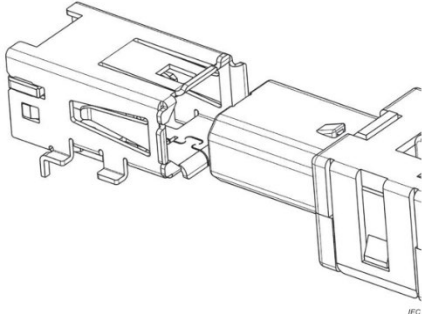
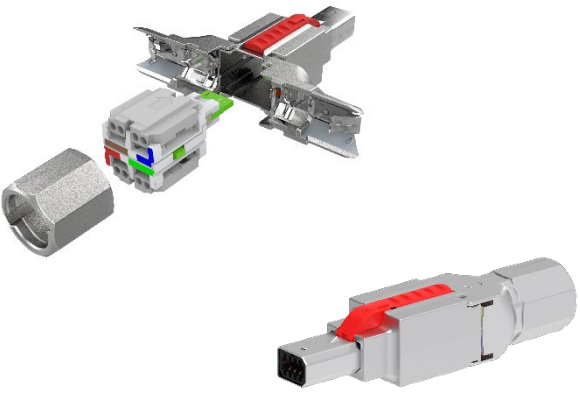
Standard/Requirement				Value	
Mechanical					
Mating cycles (mating & unmating)				100 min	
Electrical					
Rated current				0,5 A	
Transmission performance				IEC 61076-2-109 Cat. 6A	
Power / Signal	IEEE 802.3 Signal	PROFNET Colour-code	PROFNET	Fixed connector	Free connector
	Gigabit Ethernet MDI		Pair		
1	BI_DB+	White/ Orange	Pair 2		
2	BI_DB-	Orange			
3	BI_DA+	White/ Green	Pair 3		
8	BI_DD+	Blue	Pair 1		
7	BI_DD-	White/ Blue			
4	BI_DA-	Green	Pair3		
5	BI_DC+	White/ Brown	Pair 4		
6	BI_DC-	Brown			

8.2.6 Miniaturized 4-pair Connector according to IEC 61076-3-122 (Mini IO)

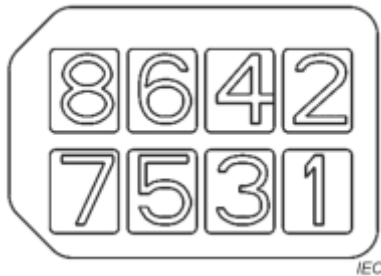
Miniaturized PROFINET connectors according to IEC 61076-3-122 and IEC 61076-3-124 are PROFINET Specific Passive Components (SPC) approved only for special applications. They support balanced 4-pair Ethernet transmission and are not intended as standard PROFINET interfaces.

These connectors are particularly suited for miniaturized cabinet connectivity, including internal-to-internal and internal-to-external connections within control cabinets. Their use is restricted to defined PROFINET applications with specific space and integration requirements, where compact connector design is essential.

Table 58: Miniaturized 4-pair Connector according to IEC 61076-3-122 (Mini IO)

PROFINET Connector Type:	PROFINET Specific Passive Components (SPC) M2M connectivity miniaturized and peripheral cabinet connectivity miniaturized
Standard:	IEC 61076-3-122 Type I
Interface Type (front view):	
Product Example (picture):	

1291

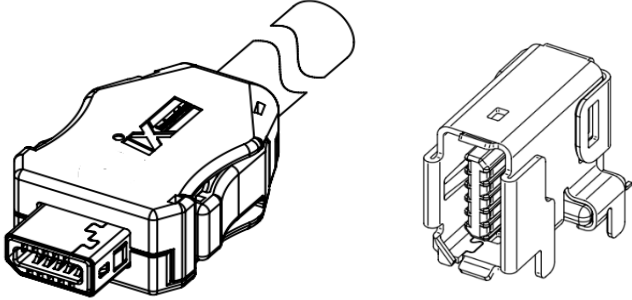
Standard/Requirement	Value		
Electrical			
Rated Voltage (IEC 60664-1)	50 V		
Current Rating	1 A		
Transmission performance (ISO/IEC 11801-1)	Cat. 6A		
	Pin	Contact	Colour PROFINET
	1	BI_DA+	White/ Green
	2	BI_DA-	Green
	3	BI_DB+	White/ Orange
	4	BI_DC+	Blue
	5	BI_DC-	White/ Blue
	6	BI_DB-	Orange
	7	BI_DD+	White/ Brown
	8	BI_DD-	Brown

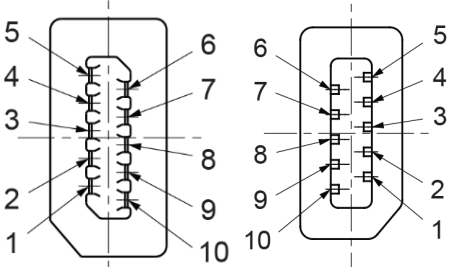
1292

1293

8.2.7 Miniaturized 4-pair Connector according to IEC 61076-3-124 (iX industrial)

Table 59: Miniaturized 4-pair Connector according to IEC 61076-3-124 (iX industrial)

PROFINET Connector Type:	PROFINET Specific Passive Components (SPC) Cabinet connectivity (intern/intern and intern/extern) miniaturized
Standard:	IEC 61076-3-124 Type A
Figures (technical drawings):	
Product Example (picture):	

Standard/Requirement	Value		
Electrical			
Rated Voltage (IEC 60664-1)	50 V a.c. rms / 60 V d.c.		
Current Rating	1,5 A		
Transmission performance (ISO/IEC 11801-1)	Cat. 6A		
	Pin	Contact	Colour PROFINET
	1	BI_DA+	White/ Green
	2	BI_DA-	Green
	6	BI_DB+	White/ Orange
	4	BI_DC+	Blue
	5	BI_DC-	White/ Blue
	7	BI_DB-	Orange
	9	BI_DD+	White/ Brown
	10	BI_DD-	Brown

1298 **8.3 Cables**1299 **8.3.1 Balanced 4 pair Cables (Type A, B, C)****Table 60: Balanced 4 pair Cable Specification Table part 1**

General Requirement:	Application Type A	Application Type B	Application Type C
Design	4 pair Data Cable		
Cable Installation Type	Stationary, no movement after installation	Flexible, occasional movement or vibration	Special Applications (e.g. highly flexible, permanent movement, vibration or torsion)
Data Element Conductor Cross Section ₁₎	AWG 23/1 ≥ 0,546 mm	AWG 23/7 ≥ 0,254 mm²	≤ AWG 24 ≥ 0,485 mm for solid conductors, ≥ 0,201 mm² for stranded coductor
Core identification (colour)	Pair 1: White / Blue Pair 2: White / Orange Pair 3: White / Green Pair 4: White / Brown White cores are allowed to be further marked with colours. Colours shall be chosen from the same colour spectrum as its corresponding core within the pair. e.g. White-Blue / Blue		
Core Diameter IEC 60811-203	1,0 mm to 1,6 mm		Application specific
Cable Design	2 cores twisted as pair and 4 pairs twisted		
Data Element Min. shielding Design	Aluminium Foil + Copper Braiding		Application specific
Outer Cable Diameter IEC 60811-203	5,5 to 9,0 mm ₂₎		
Cable Marking (at least)	“PROFINET Type A 4-Pair CATx” x ≥ 5	“PROFINET Type B 4-Pair CATx” x ≥ 5	“PROFINET Type C 4-Pair CATx” x ≥ 5
Colour (Outer Sheath)	Green RAL6018		Application specific

Table 61: Balanced 4 pair Cable Specification Table part 2

General Requirement:	Application Type A	Application Type B	Application Type C
Electrical and Transmission Requirement:			
Conductor resistance IEC 60189-1	≤ 85 Ω/km		≤ 95 Ω/km
Data Element transmission ISO/IEC 11801-1 IEC 61156-1	IEC 61156-5 (≥ Category 5)	IEC 61156-5 (≥ Category 5)	IEC 61156-6 (≥ Category 5)
Delay Skew IEC 61156-1	≤ 20 ns/100 m		
Coupling attenuation IEC 61156-5/6	Type I		
Climatic Requirement:			
Operating temperature	-20°C ...+70°C		
Mechanical Requirement:			
Type of cable	Test-Description	Measurement to be performed	Requirements
Type A, B	Flame retardancy	IEC 60332-1-2	Has to pass the test.
	Crush test of the cable	IEC 62012-1	2000 N
Type C	Application specific		

Note 1: AWG dimensions are given for information only.

Note 2) cabinet cabling with reduced outer diameter and length see Table 111: Requirements of PROFINET

General Note: Restriction of the component approach is possible according to the specification of the cable manufacturer (reduction of the E2E link length shall be defined by the vendor in the cable specification).

The core assignment of the 4-pair cable is indicated by the following colour coding.

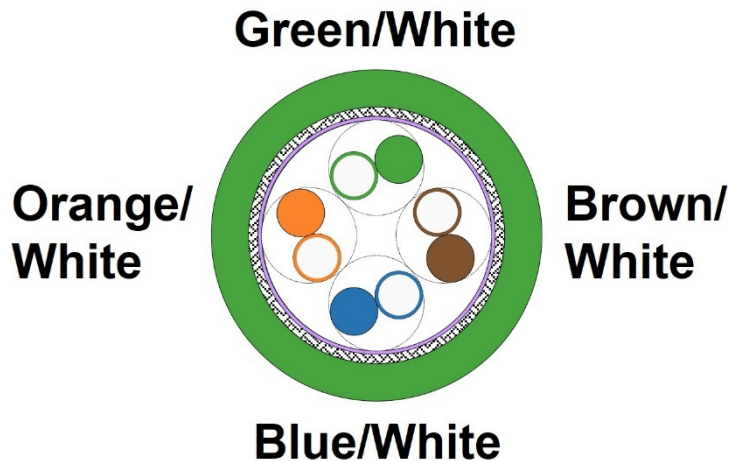


Figure 23: Cable example cross section 4-pair

8.4 Cord Sets

8.4.1 Standard Cord Set

A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system and assembled with a listed cable.

PROFINET Standard Cord meets the PROFINET requirements and can be used as part of a component approach.

PROFINET cabling is based on the End-to-End link. The End-to-End link extends the ISO/IEC 11801-3 channel about the plug connectors, which are mated to the PROFINET device (TE/PMD). End-to-End link is specified in IEC 61918.

PROFINET cord set used shall comply with the following parameters:

Table 62: Parameters of cord sets for balanced cabling

Type	PROFINET cord set
Number of wires	8
Cable Type	PROFINET cables
Connector type	GPC, SPC PROFINET connectors
Cord set marking (additional to cable marking)	"PROFINET cord set"

End-to-End link build up with PROFINET cabinet cord sets meet the PROFINET requirements.

8.4.2 Cabinet cord sets

PROFINET Cabinet cord sets are cord sets for cabinet applications. PROFINET Cabinet cord sets fulfil the PROFINET component specification and can be used concerning the PROFINET component model.

PROFINET Cabinet cord sets can be realized for field assembly as well as preassembled.

8.4.3 Configuration

Connecting hardware performance is influenced by the properties of the plug termination and therefore cords should be tested to determine the quality of the assembly.

- 1328 This chapter specifies the minimum requirements for cords. The test methods and mechanical
1329 stresses are specified in IEC 61935-2. All requirements of this chapter have to be met after first
1330 exposing the device under test to mechanical stress.
- 1331 Cords shall meet the electrical and mechanical requirements of IEC 61935-2.
- 1332 The cabinet cord sets shall meet a tightened flexures test in accordance with IEC 61935-2 7.3.
- 1333 The cabinet cord shall fulfil after the specified flexures at least the category 5 patch cord test
1334 according to ISO/IEC 11801-1.
- 1335 PROFINET cabinet cord sets shall be labelled as PROFINET cabinet cord sets.
- 1336 Cable used to build up a cabinet cord are based electrically on at least category 5 balanced LAN
1337 cables according to ISO/IEC 11801-1 Class D.
- 1338 Connectors used to build up a cabinet cord shall be based on the mating face as defined in chapter
1339 8.2.
- 1340 PROFINET Cabinet cord set used shall comply with the following parameters:
- 1341
- 1342
- 1343

8.4.4 PROFINET Cabinet cord set specification

Test parameters are described in the IEC 61784-5-3.

The cable used to build up a cabinet cord shall comply with the following standards:

Table 63: PROFINET Cabinet cord set specification Table part 1

General Requirement:	PROFINET Cabinet cord set
Type	4-Pair
Comment	only harnessed cord sets are defined
PROFINET Component	Yes
Application	Inside enclosure
Conductor Cross Section ¹⁾	AWG 26 - 22 0,14 - 0,38 mm ²
Conductor design	stranded
Number of cores	8
Core identification (colour)	Pair 1: White / Blue Pair 2: White / Orange Pair 3: White / Green Pair 4: White / Brown White cores are allowed to be further marked with colours. Colours shall be chosen from the same colour spectrum as its corresponding core within the pair. e.g. White-Blue / Blue
Colour (Outer Sheath)	Green RAL6018
Cabinet cord set marking (at least)	"PROFINET cabinet cord 4-Pair"
Cabinet cord set length	max. 5 m
Electrical and Transmission Requirement:	
Conductor resistance IEC 60189-1	≤ 148,0 Ω/km
Cable Data Element transmission	IEC 61156-6 ≥ Category 5
Delay Skew	≤ 20ns/100m
Cable Coupling attenuation	IEC 61156-6 Type I
Channel performance	IEC 11801-1 Class D
Connector Coupling	IEC 62153-4-12 max. 45 dB
Climatic Requirement:	
Operating temperature	-20°C ... +70°C

Mechanical Requirement:	
Flame retardancy IEC 60332-1-2	Has to pass the test.
Crush test of the cable IEC 62012-1	1000 N

Note 1) AWG dimensions are given for information only.

General Note: Requirements beyond the scope of this guideline shall be agreed upon between the user and the manufacturer.

- 1349
- 1350 The connectors used to build up a cabinet cord shall be in accordance with the specification of the
- 1351 inside connector in chapter 8.2.
- 1352 The Qualification Test for the cabinet cord sets shall meet return loss (RL) and Next requirements
- 1353 specified in ISO/IEC 11801-1 for balanced cords (at least category 5).

- 1354
- 1355
- 1356 **9 Cabling System FO**
- 1357 **9.1 Scope**
- 1358 This guideline provides an updated and comprehensive overview of PROFINET cabling systems
- 1359 based on fibre optic technology, covering connectors and cables for industrial Ethernet
- 1360 (PROFINET) applications.
- 1361 Fibre optic cabling offers high bandwidth, long transmission distances, and immunity to
- 1362 electromagnetic interference, making it ideal for industrial applications that require reliable, high
- 1363 speed data transmission over long distances or in electrically noisy environments. In addition, fibre
- 1364 provides galvanic isolation, enhancing safety in high voltage or explosive atmospheres.
- 1365 In PROFINET applications, polymer optical fibres (POF) and polymer clad fibres (PCF) are typically
- 1366 used for short distance 100 Mb/s links of up to approximately 50–100 m, due to their ease of
- 1367 installation, but with higher attenuation and lower bandwidth compared to glass fibres.

- 1368 For longer distances or higher data rates (e.g., Gigabit Ethernet and beyond), all silica multimode
- 1369 and single mode glass fibres are the preferred medium. They support link lengths ranging from
- 1370 several hundred to several thousand meters, depending on the transceiver type and fibre grade.

- 1371
- 1372 **9.1.1 System landscape**
- 1373 The fibre-optic Cabling System includes passive and active components, sensing technologies,
- 1374 software, and a wide range of stakeholders who plan, supply, install, and operate the
- 1375 infrastructure. The passive infrastructure comprises single-mode (SM) and multimode (MM) fibres,
- 1376 outdoor and indoor cables, ducts, trays, splice enclosures, connectors (e.g., LC, SC, ST), and
- 1377 protective housings. Active optical components include SFP, SFP+, and QSFP transceivers,
- 1378 optical amplifiers, and optical switches.

- 1379 Network equipment includes industrial switches and routers with fibre ports that are designed for
- 1380 ruggedized industrial form factors.

- 1381
- 1382

9.1.2 Description of typical applications

When implementing PROFINET over fibre, typical use cases include:

- Inside enclosures (control cabinets): short fibre patch cords or jumpers provide EMI-resistant connections between devices (PLCs, I/O modules, industrial switches) within control cabinets, often using multimode or single-mode glass fibre to support high data rates in high-density environments.
- Outside enclosures (field installations): longer-distance or harsh-environment links (up to several kilometers) between field devices or between machines (M2M connections), typically using tightly buffered industrial fibre-optic cables (multimode or single-mode) with robust connectors to ensure dust and moisture resistance (IP65/IP67).
- Modular and motion applications: specialized fibre-optic cabling for moving machinery or modular production units, requiring high-flex cables (Type C) or hybrid solutions (e.g., combined fibre data and 24 V power in a single connector or cable, such as LC push-pull-based solutions).
- Uplink connections: high-speed backbone links (e.g., connecting machinery to control rooms or plant IT infrastructure) often require long-reach fibre—commonly single-mode—to span distances of up to 1,000 m or more without repeaters and to integrate with structured cabling systems (e.g., ISO/IEC 11801) in plant networks.

The guideline describes individual cabling eco-systems that can be used for PROFINET:

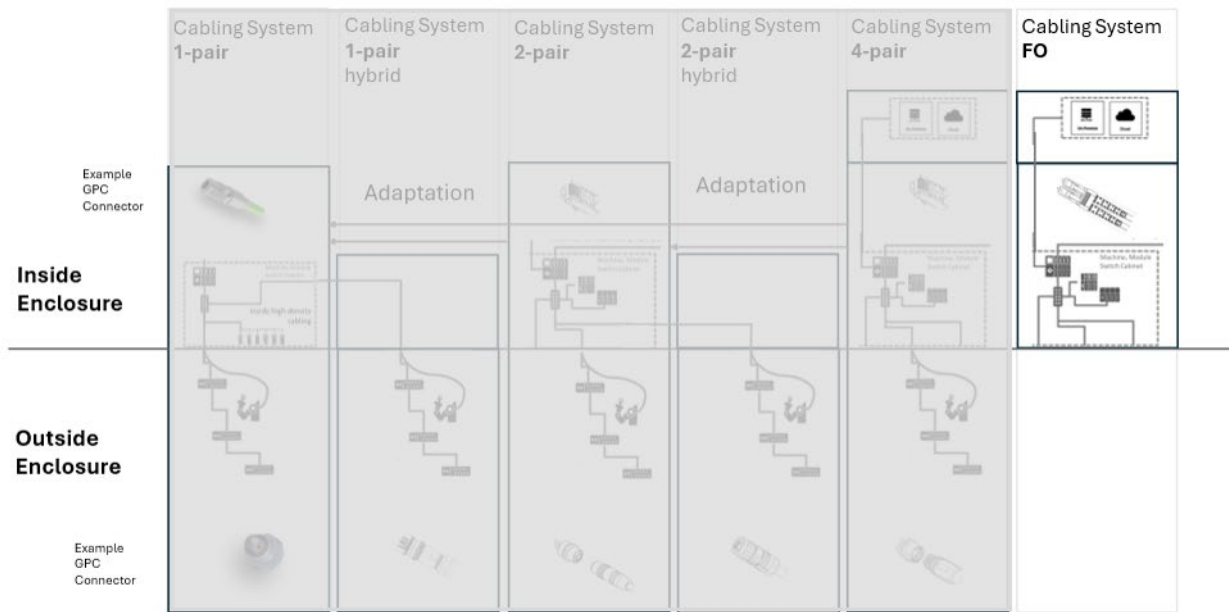


Figure 24: The PROFINET cabling system FO

Overall, PROFINET fibre-optic connectivity supports only point-to-point links (each transmitter is connected to a single receiver, requiring a fibre pair for full-duplex communication). Standard star and ring network topologies are implemented using point-to-point fibre links in combination with active network devices (such as switches with fibre ports, media converters, etc.).

9.2 Connectors

9.2.1 General requirements

PROFINET connectors are assigned based on their intended use and specific application areas. SPC (Specific Passive Connectors) are used exclusively for applications with special requirements and are therefore tied to those specific use cases; see the table below for details. In standard application areas such as cabinet wiring and field installation, only GPC (General Passive Components) shall be used.

Connectors optimized for Type C cables are permitted. These connectors may be adapted to match specific cable parameters. However, the component-based approach is not supported for Type C cables. Connectors used in cabinet cords can be matched, but no vendor declaration is provided for these pre-assembled connectors.

All fibre types claiming PROFINET compliance must be fully tested in accordance with ISO/IEC 61753. Each test shall meet the requirements specified in that standard. The testing methods shall follow the guidelines of the IEC 61300 series.

Fibre-optic technology supports only point-to-point connections, meaning that one transmitter can be connected to only one receiver (transmitter → receiver). The transmission path between two nodes therefore requires two fibres, one for each transmission direction.

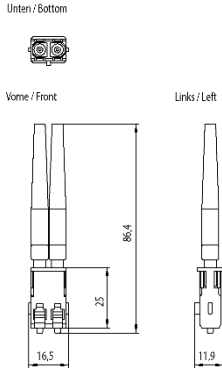
9.2.2 Connector Type SC-RJ

(according to IEC 61754-24)

The SC-RJ is a duplex plug connector set characterized by a nominal ferrule diameter of 2.5 mm and a push-pull coupling mechanism. It features three male keys: two for orienting and limiting the ferrule positions, and one for the overall orientation of the duplex connector. The adapter uses a resilient sleeve for optical alignment, while the active device interface may utilize either a rigid bore or a resilient sleeve.

The SC-RJ connector is the primary connector used for PROFINET fibre-optic connections (POF and PCF).

Table 64: Connector according to IEC 61754-24

PROFINET Connector Type:	PROFINET General Passive Component (SPC) Fibre optic connector SC-RJ of inside enclosure
Standard:	IEC 61754-24
Figures (technical drawings):	Connector front and side view  The technical drawings show the connector from three perspectives: 'Unten / Bottom' (a small top-down view), 'Vorne / Front' (a side view with dimensions 16.5, 25, and 86.4), and 'Links / Left' (a front view with a dimension of 11.9).
Product Example (picture):	 Two physical SC-RJ connectors are shown: one with a blue housing and one with a yellow housing. Both have two fiber ports.

SC-RJ connectors are available in different colours to distinguish the fibre type (for example, green housings for glass-fibre SC-RJ and yellow or black housings for POF/PCF in some implementations), although the standard does not specify any fixed colour coding.

Table 65: Standard requirements of connector

Standard/Requirement	Value
Climate / Environmental	
Operating Temperature	-20°C – 70°C
Degree of protection (IEC 60529)	IP20

Table 66: Key characteristics of connectors

Area	Key characteristic		
Number of contacts	2 fibre ferrules		
Contacts (contact details, ...)	POF, PCF, GOF		
	POF	PCF 2,2 mm	GOF
Fibre dimension	POF 980/1000 µm (acc. To IEC 60793-2 A4a)	PCF 200/230 µm (acc. To IEC 60793-2 A3C)	Multimode (G50/125 µm, G62.5/125 µm) Singlemode (9/125 µm)
Primary coating	n.a.	n.a.	250 µm
Secondary coating	n.a.	0,5 mm	900 µm 1,4mm
Mated pair transmission performance			
Maximum insertion loss (IEC 61300-3-34)	POF 1,5 dB	PCF 1,5 dB	MM 0,75 dB SM 0,75 dB

9.2.2.1 Feasible cables

The SC-RJ connector is the main connector used for PROFINET fibre-optic connections (POF and PCF).

The SC-RJ POF plug is used for assembling polymer optical fibre cables, and the maximum cable length between two Industrial Ethernet devices is 50 m.

The SC-RJ PCF plug is used for assembling polymer-clad fibre-optic cables, and the maximum cable length between two Industrial Ethernet devices is 100 m.

For more information on cables, see Chapter 9.3.

9.2.3 Connector Type LC

(according to IEC 61754-20)

The LC connector is the main connector used for PROFINET multimode and single-mode glass fibre connections.

The LC connector family features a simplex plug connector set in a plug/adaptor/plug configuration, defined by the following characteristics:

The LC connector features a 1.25 mm ferrule, a spring-loaded ferrule aligned with the optical axis, a single latch and a male key for positioning, and optical alignment via a rigid or resilient sleeve.

Only the essential dimensions required for proper plug-to-adapter mating are provided.
Non-standard plugs may not fit correctly.

Table 67: Connector according to IEC 61754-20

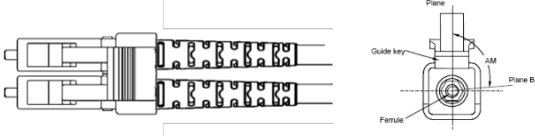
PROFINET Connector Type:	PROFINET General Passive Component (GPC) Fibre optic connector LC cabinet for single- and multi- mode fibre types
Standard:	IEC 61754-20
Figures (technical drawings):	
Product Example (picture):	

Table 68: Standard requirements of connectors

Standard/Requirements	Value
Climate / Environmental	
Operating Temperature	according to "Inside enclosure"
Degree of protection (IEC 60529)	according to "Inside enclosure"

1478 **Table 69: Key characteristics of connectors**

Area		Key characteristic	
Robustness		Values of inside enclosure according to Table 2	
Number of contacts		2 fibre ferrules	
Contacts (contact details, ...)		Different ferrule types for Multimode, Singlemode	
Locking mechanism		Latch	
Fibre Termination		Fibre termination field and pre-manufactured available	
Outer Cable Diameters (range)		The connector shall be terminated onto PROFINET optical fibre cable	
Wire-Cross	Nominal diameter cladding	Glass 125 µm	IEC 60793-2 A1-OMx, A1-OM1 and B-652, B-654
	Primary coating		250 µm
	Nominal diameter secondary coating	Multimode 1,4 mm Singlemode 1,4 mm	Multimode 900 µm Singlemode 900 µm
Outer diameter		Multimode min 2,4 – max.3,0 mm	
		Singlemode min 2,4 – max.3,0 mm	

1479 **9.3 Cables**1480 **9.3.1 General requirements**

1481 Fibre-optic (FO) cables transmit data by modulating electromagnetic waves in the visible and
1482 invisible light spectrum. They are made from high-quality plastic or glass fibres.

1483 This section focuses exclusively on FO cables designed for PROFINET in Industrial Ethernet
1484 applications.

1485 Various FO cable types are available to ensure reliable connections between components, tailored
1486 to specific operating and environmental conditions.

1487 Fibre-optic technology allows only point-to-point links; in other words, one transmitter is connected
1488 to only one receiver. The transmission path between two nodes requires two fibres (one for each
1489 transmission direction). With optical components for Industrial Ethernet, bus, star, and ring network
1490 topologies can be implemented using network switches.

1491

1492

- 1493
- 1494 PROFINET classifies cables according to mechanical application requirements:
- 1495 Type B:
- 1496 Flexible installation cables (for occasional movement, moderate flexing, or vibration). These can
1497 be routed in machines or cable trays where some flexing occurs.
- 1498 Type C:
- 1499 Highly flexible cables for continuous movement (e.g., robotics, drag chains, torsion applications).
1500 These have a reinforced construction to withstand frequent bending, torsion, or rolling.

- 1501
- 1502 **9.3.2 All-silica single mode optical fibre cables**
- 1503 Singlemode fibre is an optical fibre with a small core diameter (typically 8–10 µm) that allows only
1504 one mode of light to propagate. This minimizes signal dispersion and enables extremely high
1505 bandwidth over long distances. It is ideal for long-haul telecommunications, metro networks, and
1506 high-speed data transmission over distances of several kilometers.
- 1507 Singlemode fibres operate primarily at wavelengths of 1310 nm and 1550 nm, supporting very high
1508 bandwidth and transmission distances ranging from tens to hundreds of kilometers with minimal
1509 signal loss.
- 1510 Unlike multimode fibres, singlemode fibres are not classified by OM categories but by OS (Optical
1511 Singlemode) standards such as OS1 and OS2.

- 1512
- 1513 **Table 70: General Requirement**

All-silica single mode	Application Type B	Application Type C
Cable Design	2 All-silica single mode optical fibre data cable	
Cable Installation Type	stationary, flexible, depending on cable construction	Special Applications (e.g. highly flexible, permanent movement, vibration or torsion)
Cable Marking (at least)	PROFINET Type B + fibre type i.e.: PROFINET Type B 2E9/125	PROFINET Type C + fibre type i.e.: PROFINET Type C 2E9/125
Core/cladding diameter IEC 60811-203	9/125 µm	
Primary coating	250 µm	
Diameter secondary coating IEC 60811-203	900 µm 1,4 mm ± 0,1 mm	

Colour (subcable)	orange + black orange with arrow (pointing direction of data stream)	
Diameter subcable IEC 60811-203	min 2,4 – max. 3,0 mm	
Outer cable diameter IEC 60811-203	≤ 9,5 mm	≤ 9,5 mm
Colour (Outer Sheath)	Green RAL6018	

Table 71: Transmission Requirement

All-silica single mode	Application Type B	Application Type C
Requirements, Class IEC 60793-2	B1	
Nominal wavelength	1310 nm	
Cut-off wavelength IEC 60793-1-44	< 1260 nm	
Maximum attenuation @1310 nm IEC 60793-1-40	0,5 dB/km	Application Specific

Table 72: Ambient Condition Requirement

All-silica single mode	Application Type B	Application Type C
Operating temperature IEC 60794-1-2, Method F1	-20°C ...+70°C 2 cycles; t1=24h; max. 1,0 dB/km (@ 1300 nm)	

Table 73: Mechanical Requirement

All-silica single mode	Test-Description	Measurement to be performed	Requirements
Type B cable	Tensile performance long term of the cable	IEC 60794-1-2, Method E1	600 N; 100 m length; max. 1,0 dB ΔA (@ 1300 nm)
	Bending radius	IEC 60794-1-2, Method E11A	>15 times cable diameter 5 turns, 1 cycle, max. 0,1 dB (@ 1300 nm)
Type C cable	Application specific		

9.3.3 All-silica multimode optical fibre cables

Multimode fibre is a type of optical fibre designed for short-distance, high-bandwidth data transmission. Multimode fibre (MMF) cables used in PROFINET applications employ 50/125 µm or 62.5/125 µm all-glass fibres. The relevant standards classify these as A1 category fibres according to IEC 60793-2 (A1-OM1, A1-OM2, A1-OM3, etc., corresponding to OM1, OM2, and OM3/OM4/OM5 grades of multimode fibre).

They commonly operate at a wavelength of 850 nm (and at 1300 nm in older systems using LED sources) and can reliably transmit high-speed data over distances of several hundred meters.

Table 74: General Requirement

All-silica multimode mode	Application Type B	Application Type C
Cable Design	2 All-silica multimode mode optical fibre data cable	
Cable Installation Type	stationary, flexible, depending on cable construction	Special Applications (e.g. highly flexible, permanent movement, vibration or torsion)
Cable Marking (at least)	PROFINET Type B + fibre type i.e.: PROFINET Type B 2G50/125 PROFINET Type B 2G62,5/125	PROFINET Type C + fibre type i.e.: PROFINET Type C 2G50/125 PROFINET Type C 2G62,5/125

Core/cladding diameter IEC 60811-203	G50/125 µm G62,5/125 µm	
Primary coating	250 µm	
Diameter secondary coating IEC 60811-203	900 µm 1,4 mm	
Colour (subcable)	orange + black orange with arrow (pointing direction of data stream)	
Diameter subcable IEC 60811-203	Min. 2,4mm – max. 3,0mm	
Outer cable diameter IEC 60811-203	max. 9,5 mm	Application Specific
Colour (Outer Sheath)	Green RAL6018	

Table 75: Transmission Requirement

All-silica multimode mode	Application Type B	Application Type C
Requirements sub-categories IEC 60793-2	A1-OMx, A1-OM1	
Maximum link length	2000 m	
Nominal wavelength	1310 nm	
Bandwidth MHz referred to 1 km IEC 60793-1-41	>=500 MHz	
Maximum attenuation @1310 nm IEC 60793-1-40	1,5 dB/km	Application Specific

Table 76: Ambient Condition Requirement

All-silica multimode mode	Application Type B	Application Type C
Operating temperature IEC 60794-1-2, Method F1	-20°C ...+70°C 2 cycles; t1=24h; max. 1,0 dB/km (@ 1300 nm)	

Table 77: Mechanical Requirement

All-silica multimode mode	Test-Description	Measurement to be performed	Requirements
Type B cable	Tensile performance long term of the cable	IEC 60794-1-2, Method E1	600 N; 100 m length; max. 1,0 dB ΔA (@ 1300 nm)
	Bending radius	IEC 60794-1-2, Method E11A	>15 times cable diameter 5 turns, 1 cycle, max. 0,1 dB (@ 1300 nm)
Type C cable	Application specific		

9.4 Cord Sets

9.4.1 Standard Cord Set

A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system and assembled with a listed cable PROFINET Standard Cord meets the PROFINET requirements and can be used as part of a component approach.

10 Cabling System Power

10.1 Scope

Industrial Power cabling system is used in applications where the data cabling system is separated from the power cabling system. There are separate cables and connectors for the power and data cabling system. Most use cases for this power cabling system have a higher power demand or a demand for daisy chaining the power line.

10.1.1 System landscape

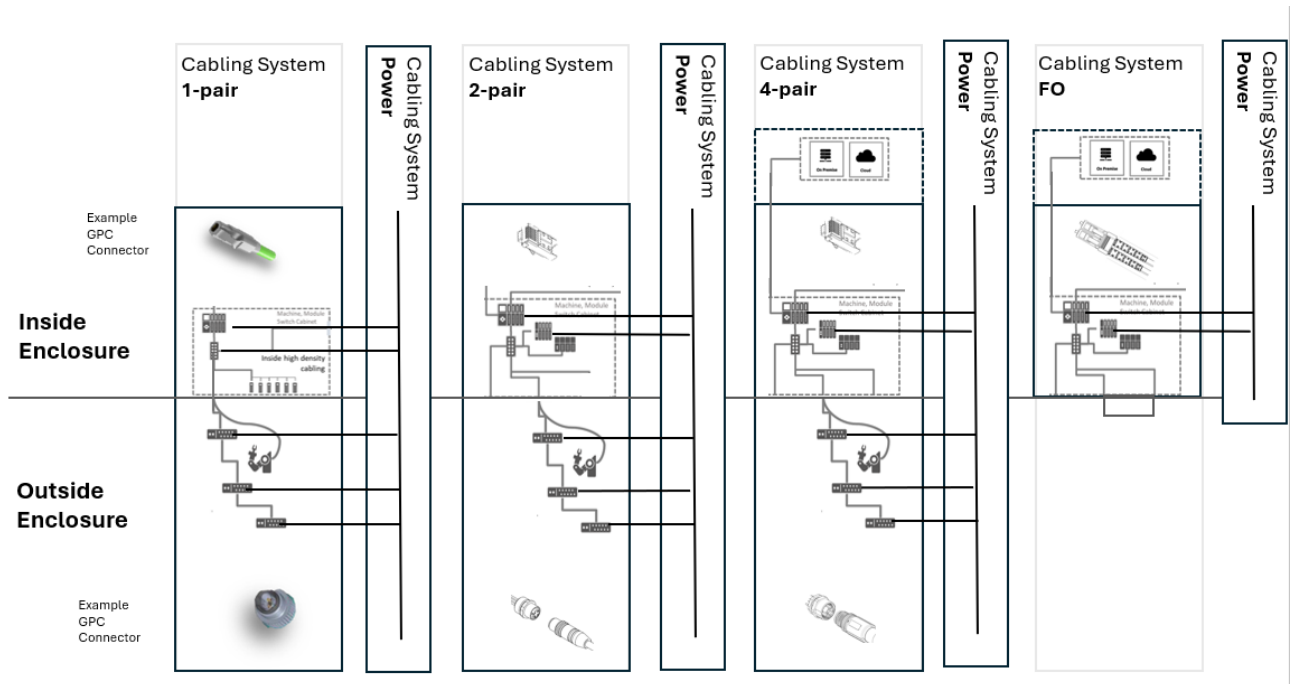


Figure 25: The PROFINET cabling system power

10.1.2 Description of typical applications

In non-hybrid application areas the power cabling system is part of the overall cabling system. Power and pure data cabling system are building together the backbone for the PROFINET infrastructure.

10.1.3 Physical layer References

IEC 61076-111 (M12-Power cabling)

IEC 61076-3-126 (PushPull Power)

10.2 Connectors

10.2.1 General requirements

PROFINET 24 V Cabling is intended to be used either with an integrated functional earth (FE) or without a functional earth. There are dedicated connectors and cable designs.

PROFINET recommends the termination to the functional earth (FE) by an external termination point on the device. In this case the 4-way power cabling without functional earth (FE) shall be used.

All PROFINET devices shall be equipped with an external functional earth (FE) termination point. For further information see guideline Order Number 8.101 (Recommendations for functional grounding and bonding).

10.2.1.1 Push-Pull 4-way Power Connector for 24V

Table 78: Key Characteristics Push-Pull, Power 5-way M12 power IEC 61076-3-126

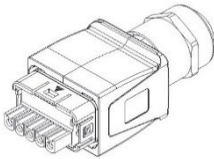
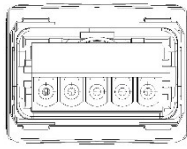
PROFINET connector Type:	PROFINET Special Passive Components (SPC)
Standard:	IEC 61076-3-126
Figures (technical drawings):	
Interface:	
Product Example (picture):	

Table 79: Standard requirements of connectors according to IEC 61076-3-126

Standard/Requirement	Value
Electrical	
Operating Voltage	24V
Current Rating	16A

Table 80: Connector according to IEC 61076-3-126 –Push Pull Power 5 way

Connector				Cable	
	Function	Signal	Contact	Function	Colour
		L1	1	L1	Brown
		N1	2	N1	Blue
		L2	3	L2	Black
		N2	4	N2	White
	Optional	FE	FE	FE	Pink or Grey

10.2.2 Connector Type M12 Power L-coded**Table 81: M12 Power L-coded**

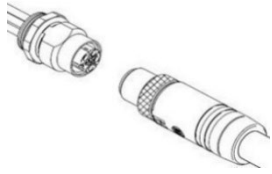
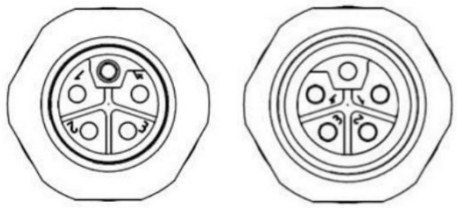
PROFINET connector Type:	PROFINET General Passive Component (GPC) M12-L coded 4 way optional 5-way PROFINET 24 V power supply connector for outside environment
Standard:	IEC 61076-2-111 M12-L-coded
Figures (technical drawings):	
Interface:	
Product Example (picture):	

Table 82: Standard requirements M12 power L coded connector according to IEC 61076-02-111

Standard/Requirement	Value
Electrical	
Operating Voltage within PROFINET	24 V
Current Rating	16 A

Table 83: Pin assignment M12 power L coded 4 way according to IEC 61076-2-111

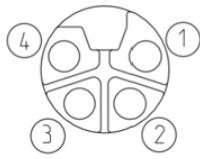
Connector according to IEC61076-2-111 – L-coded 4 way				Cable Colour outer sheet black	
	Function	Signal	Contact	Function	Colour
		L1	1	L1	BN
		N2	2	N2	WH
		N1	3	N1	BU
		L2	4	L2	BK
	Colour (insulation body):	black			

Table 84: Pin assignment M12 power L coded 5 way according to IEC 61076-2-111

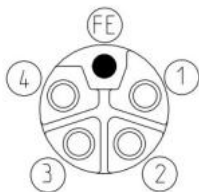
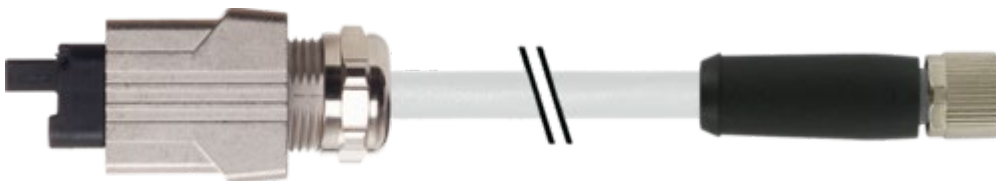
Connector according to IEC61076-2-111 – L-coded 5 way				Cable Colour outer sheet grey	
	Function	Signal	Contact	Function	Colour
		L1	1	L1	BN
		N2	2	N2	WH
		N1	3	N1	BU
		L2	4	L2	BK
	Functional Earth (optional)	FE	FE	FE	PK or GY
Colour (insulation body):		grey			

Table 85: Pin assignment M12 power L coded 5 way according to IEC 61076-2-111

Potential	Contact Number Push Pull Power	Push Pull Colour Coding	Contact Number M12-L- coded	Additional M12-L Colour Coding
L1	1	Brown	1	Brown
N1	2	Blue	3	Blue
L2	3	Black	4	Black
N2	4	White	2	White
FE	FE	Pink or Grey	FE	Pink or Grey

**Figure 26: Example of Push Pull Power to M12 power L coded**

10.3 Assigned Cables for power

Table 86: Assigned Cables for power

PROFINET 24V DC Power Cable Types	PROFINET 24V Power Cable 0,75 mm ² up to 2,5mm ²
Cable Installation Type	Fixed and flexible installation, occasional movement or vibration
Design Corresponding IEC 60228 class 5	4 x 0,75 mm ² - 2,5mm ² 5 x 0,75 mm ² - 2,5mm ²
Wall thickness sheath Acc. to IEC 60811-203	min. 0,8 mm
Outer cable diameter Acc. to IEC 60811-203	Max. 12,5 mm
Current-carrying capacity per conductor at 40°C ambient temperature ¹⁾	acc. to VDE 0298-4
Rated voltage	24V
Core identification	1 to 4 cores with colours: Brown (L1), Blue (N1), Black (L2), White (N2) Alternative: black with numbering Functional Earth: Pink or Grey
Colour (Outer Sheath)	Black (without Functional Earth) or Grey (with Functional Earth)
Cable Marking (at least)	Mandatory: Without Functional Earth "PROFINET 24V Power 4x{cross section}^b ...^a... e.g. "PROFINET 24V Power 4x2,5mm²" Or With Functional Earth: "PROFINET 24V Power 4x{cross section}^b + FE " ...^a... e.g. "PROFINET 24V Power 4x2,5mm²+FE" ...^a... ^a Additional printings are upon agreement between manufacturer and user ^b Text between { } defines content to be selected { } are not to be printed on the cable.
Operating Temperature Range	-20°C+80°C
Flame retardancy	IEC 60332-1-2
Voltage test on completed cable acc. to IEC60227-1 table 3	Test voltage 1500V
Trailing chain test (bending test in trailing chain at room temperature)	bending radius: 12xD; acceleration: 3 m/s ² ; speed: 3 m/s min. cycles. 2 mio
1) Derating in accordance with IEC 60204-1 und IEC 60364-5-52	

10.4 Cord Sets**10.4.1 Standard Cord Set**

A PROFINET standard cord set consists of a GPC, SPC connector defined for the cabling system and assembled with a listed cable. PROFINET standard cord set meet the PROFINET requirements and can be used as part of a component approach.

Cord sets shall be provided with a clear and visible identification indicating that the product is a cord set. The identification shall be applied by means of a tag, flag, adhesive label, or printed marking.

PROFINET cord set used shall comply with the following parameters:

Table 87: Parameters of standard cord set Hybrid

Type	PROFINET cord set Power
Cable Type	PROFINET cables
Connector type	GPC, SPC PROFINET connectors
Cord set marking (additional to cable marking)	"PROFINET cord set"

© Copyright by:
PROFIBUS Nutzerorganisation e. V. (PNO)
PROFIBUS & PROFINET International (PI)
Ohiostr. 8 • 76149 Karlsruhe • Germany
Phone +49 721 986 197 0 • Fax +49 721 986 197 11
E-mail info@profibus.com
www.profibus.com • www.profinet.com